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Germany: Advanced Materials Project Produces New Titanium Aluminide

MI0704065495 Berlin NTZ in German No 3, Mar 95 p 46

[Unattributed report: "Materials for High Temperatures"]

[FBIS Translated Text] The aerospace and engine and turbine construction sectors require light-weight, strong, particularly heat-resistant materials, applications for which gamma titanium aluminide-based materials are ideally suited. A project funded by the Federal Ministry of Education, Science, Research, and Technology (BMBF) has now succeeded in producing sheet metals of this type for the first time on an industrial scale.

Intermetallic alloys are compounds of various metals presenting ordered crystal lattice structures and very high bonding strengths between the different atoms. Such materials thus prove significantly harder, stronger, and more rigid than their initial components.

Intermetallic gamma titanium aluminides have a much higher oxidation resistance than conventional titanium alloys and, what is more, they do not tend to ignite at high temperatures in an oxygen atmosphere—a phenomenon known as "titanium fire." Intermetallic compounds also present much better mechanical properties, such as creep resistance and elasticity, whereas their density is less than 50 percent that of the nickel-based alloys now widely used at high temperatures.

An input stock suitable for subsequent sheet metal pressing was produced by thermomechanical shaping of the casting alloy. A cladding technique [Kapseltechnik] developed for the production of the metal sheets makes it possible to work at more or less constant temperatures on conventional industrial hot rolling machines—a prerequisite for uniform product quality. Crack-free sheets measuring 760 x 300 mm and 1.6 mm thick were thus obtained.

In the rolled state, the metal sheets show a very fine-grained microstructure that presents superplasticity characteristics at high temperatures. These excellent shapability properties can be exploited to shape complex components. The microstructure and grain size of the metal sheets can be varied over a wide range so as to optimize their mechanical properties for specific applications.

Germany: New Process Produces Uniform Nanoparticles

95WS0280A Duesseldorf VDI NACHRICHTEN in German 3 Mar 95 p 18

[Article by Karin Schmitz under the rubric "Research": "New Processes Facilitating Production and Processing of Microfine Powder. Nano-Devil Is in the Nuts and Bolts"; first paragraph is an introduction]

[FBIS Translated Text] **Duesseldorf, 3 Mar 95 (VDI-N)—Nanopowders with particles less than 100 nanometers in diameter are making it possible to produce new materials. Optimized processes are producing powders having a more uniform particle size, thus facilitating their processing in dispersions.**

The size of the nanoparticles—from 5 nm to 100 nm—(a nanometer is a millionth of a millimeter) is the reason for several interesting properties that coarse-grained powders of the same composition do not display: the smaller grain dimensions of a material produced from a nanopowder increase not only its hardness, strength and thermal shock resistance, but also enable the construction of ever smaller components. The tiny particles in addition result in lower sintering temperatures and thus in simplified further processing and lower costs. The powder's large specific surface also can be utilized for purposes of catalysis.

The production processes current today have the drawback that the nanopowders formed display a wide spread of particle sizes. But uniform particle size is the prerequisite for their further processing.

A recent DECHEMA [German Society for Chemical Apparatus] show in Frankfurt introduced a new process for producing nanopowders having an extremely narrow particle size spread. In a process called the CVR (Chemical Vapor Reaction) process, various nitrides, carbides, oxides and metallic powders were produced whose particle sizes, which can come to between 5 and 50 nm, display an extremely small spread. Dr. Theo König of the H.C. Starck GmbH [Ltd.] company in Laufenburg, which developed the CVR process, explains, "The nucleation of each particle has to take place at the same place in the reactor, and each particle has to have the same length of stay under the same conditions in the reactor."

These prerequisites were able to be fulfilled by means of a newly developed hot-wall tubular reactor. The raw materials are heated separately from one another to the reaction temperature and are then conducted into the reactor, so that nucleation takes place immediately when they meet in the reactor. An inert layer that prevents a wall reaction—one of the main causes of unequal particle sizes—forms on the inside wall of the reactor through the additional injection of argon.

The process is presently being tested in a pilot plant that produces a few kilograms of nanopowder per hour. "In spite of the small quantities, it pays, because the powder is relatively expensive," says König. Though the cost is around 1,000 German marks [DM] per kilogram with annual production of 10 tons, "nevertheless in most cases one needs only small amounts to produce the desired effect." He sees potential applications in the fields of cutting-tool ceramics, sensors, pigments or coatings.

The tendency of nanopowders to agglomerate presents another problem in dealing with them. This agglomeration results in irregularly put-together structures in the synthesis of materials, and thus in the irregular shrinkage of components in the sintering process. For this reason

the powders are dispersed in liquids of which suitable amounts are added to bring about the mutual repulsion of particles.

Short-chain bifunctional organic compounds—like carboxylic acids or various complexing agents, for instance—introduced by Dr. Rüdiger Nass of the Saarbrücken Institute for New Materials in Frankfurt, represent progress in the processing of nanopowders. For conventional stabilization measures such as the generation of surface charges cannot be used for nanopowders, because they repel the nanoparticles too far from one another and thus lower the solids concentration of such a dispersion so strongly that processing is no longer possible.

By comparison, short-chain substances that are absorbed on the surface of the particles bring about only weak repulsion sufficient to prevent agglomeration without thinning the dispersion excessively.

Such nanopowder dispersions can also be used for making injection-molded parts. According to Nass, a dispersion of TiN powder, for example, having a particle size of 30 to 40 nm (solids concentration of 40 percent by weight) can be stabilized with guanidine-propionic acid. For instance, one can make molded items that can be sintered below 1400°C without the addition of sintering additives, where otherwise at least 1800°C would be required.

Netherlands: Shell Develops High-Quality Plastic

BR2803083695 Amsterdam TECHNISCH WEEKBLAD in Dutch 15 Mar 95 p 3

[Report by Gerard van Nifterik: "Shell's New Superplastic Is Strong, Tough, and Hard"]

[FBIS Translated Text] Shell recently launched a new plastic which is being marketed under the name "Carilon Polymer." Shell says that its new product, of which it has high expectations, is a high-quality technical plastic that should be able to compete with often much more expensive high-performance plastics and engineering plastics. Carilon's properties mean that it can be used for a wide range of applications. The material is strong, tough, hard, chemically resistant, maintains its impact resistance even at minus 30° centigrade, and does not distort at high temperatures.

According to Shell, a molecule consists of perfectly alternately linked molecules of carbon monoxide and ethylene. For decades attempts have been made all over the world to develop a suitable copolymerization process for this type of polymer. Shell stated that it had developed a production process, with the discovery of Carilon, that is commercially attractive and delivers a product of the desired stability.

The discovery of Carilon is a traditional case of coincidence. Elite Drent, a researcher at the Royal Netherlands Shell Laboratory in Amsterdam (KSLA), was actually looking for a catalyst to make methylpropionate from ethylene, carbon monoxide, and methanol. During one of his experiments he appeared to have made a polymer rather than the intended solvent. A crucial aspect of this was a (homogeneous) palladium catalyst with which a versatile copolymer could be made under certain circumstances.

Following Drent's discovery, a large-scale research project was launched. This also had to deal with other fundamental questions relating to the exact composition of the homogeneous catalyst. In addition to a promising plastic, this research eventually also led to a large number of patents.

In order to satisfy the demands for larger quantities of Carilon, in 1986 a so-called market development center was secretly opened on the site of Shell Nederland Chemie in Moerdijk. Today's as yet low production of a couple of hundred tonnes per year is partially intended for Shell Laboratories. Another share of production is used for product research to find potential customers in industry.

Building the first commercial factory has recently started. One unit in Carrington, UK will be built up in phases to reach a production capacity of 20,000 tonnes per year.

Carilon is simple to process using basic processes such as injection molding and extrusion. As a result of its rapid crystallization speed, the polymer only has to stay in the mold for a short time. Shell believes that production capacity could be 50 percent higher than that of other plastics. Carilon's fields of application include electrical and electronic engineering, domestic products, and industry. The material is easy to recycle.

Switzerland: Better Lubricants From Fullerenes Considered Possible

95P60147A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Mar 95 p 8

[Unattributed article: "Better Lubricants From Fullerenes"; "Molecular Changes Necessary Before Application"]

[FBIS Translated Text] The three-dimensional structure of spherical fullerenes could be suitable for use as a lubricant. To study this possibility more closely, the Institute of Physics at the University of Basel (Kingelbergerstrasse 82, CH-4056 Basel) is conducting accurate studies to establish the adhesive power of C_{60}-Fullerenes on surfaces.

It appears that the sliding properties of various materials can be very different, depending on which properties of C_{60}-fullerenes are used. For example, domain-like groups of fullerenes, which can easily be moved back and forth on a device measuring about 200 namometers with a so-called scanning force microscope, originate on

devices (consisting) of crystalline sodium chloride. Scanning force microscopes are variations of atomic force microscopes, discovered by Gerd Binnig, which can be used to measure the adhesive power of atoms interchangeabley or on base materials.

Group displacement was not possible on graphite materials. Forces necessary for displacement on sodium chloride lie in the range of 0.05 to 0.1 megapascal. These are values which are an order of magnitude less than most lubricants used at present. Moreover, the measurements prove that the expended energy of each fullerene molecule is 0.25 millielectronvolt and the adhesive energy itself was only 1.5 electronvolt.

For the time being, this means that C_{60}-fullerene can hardly become a new-type lubricant, without altering the molecule. However, it appears to be possible to change the gliding quality of the molecules as a type of sliding block in nanotechnology to shift molecules.

Such manipulation on fullerenes could be used directly to produce so-called nanomolecular "workbenches," on which single or a few atoms could be fabricated and transmitted. Nanomolecular workbenches are necessary, in the view of chemists, to specially fabricate molecules, in order, for example, to produce nanomolecular switches.

Such an operating technology for atomic or molecular movement does not yet exist, since the adhesive power of atoms or molecular groups based on their materials was much too large to shift.

Future European Reusable Launchers Discussed

Survey of European Thinking

95WS0288A Noordwijk REACHING FOR THE SKIES in English Dec 94 pp 11-12

[Article by J.-F. Lieberherr and H.A. Pfeffer: "The Road to Future European Launcher"; first paragraph is introductory paragraph]

[FBIS Transcribed Text] *The following thoughts result from a little informal survey of the opinions of several key persons in Industry and in ESA on the future of European launchers. These thoughts do not represent the views of any single industry or individual but rather the presently prevailing basis of consensus, as the authors could determine it. The contributions from outside ESA are hereby gratefully acknowledged.*

No one knows precisely what the future European space launch systems will be. They may remain expendable as they are now. If so, Europe is in a good position with its Ariane-5 launcher on which marginal improvements in cost effectiveness are still possible and which corresponds well to the predictable needs. However everything indicates that the use of expendable launchers will remain expensive, even for affluent countries, and one can no more count on a fast and large-scale expansion of space operations.

To avoid the prospect of stagnant space operations no way can be seen at this moment other than decreasing markedly the launch vehicle and operations cost via vehicle recovery, easy refurbishment and reuse. With our present technologies this leads to added mass which degrades the performance of the launcher to such an extent that the cost objectives can no more be reached. Therefore, new technologies have to be invented and developed before defining ambitious programmes on reusable launchers. The big question today is: *Which are these technologies?*

Some advocate a drastic simplification of operations to make launcher maintenance as simple as airliner maintenance; some propose very advanced propulsion, such as hypersonic airbreathing propulsion, which allows a larger empty mass for the vehicle; others suggest extremely advanced materials, which decreases the empty mass. No real consensus exists. Reality will most likely see advances in each of these domains.

In such a blurred situation ESA has given itself simple guidelines: ESA accepts that reusability should be investigated as the primary means to reduce launch costs compared to present levels. ESA also accepts that least complex vehicles, based on technologies close to being within reach, have the best chance of demonstrating low cost and represent a good starting point for technical work that may lead to more complex systems but later on. The rocket-powered single-stage-to-orbit vehicle (SSTO) is therefore ESA's favoured workhorse for the purpose of initial vehicle definition and initial technology development. Rocket propulsion systems are well known and straightforward calculations show that the necessary vehicle mass ratio, (ratio of the vehicle dry mass to the vehicle full mass at take-off) of 10-12 percent is only a few percentage points away from the state of the art.

Materials must therefore be the primary aim of the development of reusable launchers. This fact has been recognized by the NASP team and many impressive results have been achieved in the U.S. in the field of materials. Depending on the performance level that will be required to achieve low mass ratios, a decision point may be reached where one would have to decide on either pushing for further advances in materials to obtain a true SSTO or abandoning the SSTO concept in favour of a rocket-powered two-stage-to-orbit vehicle (TSTO). At this point in time the advances made on materials should already be useful to the whole of industry. Should it be necessary to go to this TSTO vehicle one would have to demonstrate that it is not as demanding as a SSTO in terms of materials performance, that the doubling of the number of stages does not add to the complexity of operations and that the TSTO nevertheless represents an economically sound orientation.

Should the rocket-powered TSTO also be proven inadequate (as well as its derivative, the air launched SSTO), other solutions would have to be investigated. This would show that the advances in the field of materials are not sufficient and that propulsion must be improved, most likely by using air-breathing technologies. The classical designs, with turbojets and ramjets, invariably show that the vehicle should continue its airbreathing phase up to a high Mach number, which leads to the scramjet. Other at least equally complex solutions have been proposed with on-board liquefaction and storage of oxygen to be used in the later rocket phase, in space. In each case lots of unknown ground must be broken. Since scramjet-based solutions are related to the expertise of the aeronautical industry and are outside the scope of ESA, it is proposed to concentrate the interest on liquefaction-based solutions, that are very intriguing and closer to rocketry. To avoid getting lost in a problem of untractable complexity, the initial efforts will be limited to understanding the most critical items, among which are the heat exchangers.

While there is a wide technical consensus throughout Europe over the above-mentioned primary aim on materials and propulsion, the consensus is less clear with respect to the second general aim of decreasing operations cost. When speaking of costs one has to distinguish between development, manufacturing and recurrent costs. Budgets will remain limited and affordability essentially means remaining within the yearly budgets. This point is all the more critical, since the concept of reusable vehicles does not lead to amortization over a large series production. The matter of manufacturing

costs is not too critical, since the costs are similar to aircraft costs, and almost incompressible, although the main difference is that an aircraft flies thousands of times and a reusable launcher should not be expected to fly more than 50 or at most 100 times. Operations cost is certainly the important point and there are few cues as to the means to decrease it. In this respect the suggestion of ESA is that since launcher development costs are already limited by the affordability of this development, since production costs are fairly standard, one should concentrate on operations and refurbishment costs. Minimising these may lead to reduced production costs as a by-product. The ESA aim is therefore achieving minimal recurrent and not development cost.

Achieving minimal recurrent cost with a configuration felt to be the right one still represents a large programmatic risk. There is an imperative need to make sure that the fundamental technologies are available or very close to being available and that they actually hold their promise. Demonstrations on paper are insufficient. Convincing demonstrations can only be done by having operational demonstrators for each critical technology, either ground demonstrators or flight demonstrators. Clearly the flight demonstrators will not have to go into orbit, which allows designing them with comfortable margins, but they have to be representative of the flight conditions of some final vehicle. ESA has already started working on the preliminary ideas for such demonstrators and this will be continued in the framework of FESTIP [Future European Space Transportation Investigation Program].

FESTIP is not only the technical framework that ESA has proposed to its Member States to prepare future European reusable vehicles, it is also a forum for the engineers and managers to prepare for future activities. Quite naturally there are different opinions on the advisability of following any one of the possible routes. By promoting a dialogue and consensus between industry specialists at an early stage, the final decision making will be much easier. In the new European context that opens progressively toward worldwide cooperation, a new balance of influence is also being progressively found between the ESA Member States, preparing perhaps the way for new members. Activities like FESTIP promote the spreading of competence and of thinking at system level and encourage interaction and initiative between Member States' industries for defining their future tasks. It is the efficient way to allow tomorrow's leaders of European space industry to emerge and to prepare the time when launcher development will be a purely industrial undertaking, when the technical unknowns and the excessive programmatic risks will have been removed.

[Box, p 12]

Future Launcher Studies at ESA

Future launcher studies in ESA have been performed since the 80's mainly in the Directorate of Space Transportation Systems (now the Directorate of Launchers) within the framework of the General Studies Programme. Significant support was received from the Systems Engineering and Programmatics Department of ESTEC [European Space Research and Technology Center] on many studies that were systems-oriented. Substantial support was also provided by the Department of Mechanical Systems of ESTEC on studies that had an important technological content.

The initiation of the FESTIP activities in 1994 calls again for a support of ESTEC, particularly in the technological activities. This will be done in the fields of Aerothermodynamics, Materials, Structures, Thermal Control and Propulsion. The cooperation of the different teams from ESA Head Office and ESTEC will thus continue, in accordance with the matrix type of organisation that ESA has chosen. [end box]

FESTIP Program

95WS0288B Noordwijk REACHING FOR THE SKIES in English Dec 94 pp 10-11

[Article by H. Pfeffer: "The FESTIP Programme Has Started"; first paragraph is introductory paragraph]

[FBIS Transcribed Text] **In issue No. 12 of this bulletin (September 1994), we announced the start of FESTIP (Future European Space Transportation Investigations Programme) and promised to report on its implementation. The present article outlines the overall aims of FESTIP.**

The FESTIP programme is designed to prepare Europe to undertake developments for future launchers beyond Ariane-5 and its evolution. Such future launchers would be developed only if they provide a drastically reduced cost for access to space.

We have therefore assumed that such future launchers will be reusable, and in past issues of this bulletin, we presented some possible configurations studied in industry with funding from the ESA General Studies programme (the Reusable Rocket Launcher, the Winged Launchers, the Demonstrators). We also mentioned that reusable launchers built with available technologies brought no improvement over the present Ariane-5 family and that new technologies would have to be developed.

Developing these new technologies is largely beyond the possibilities of any existing programme context of the Agency (such as the General Studies programme, or the Technology Research Programme). A dedicated programme, called FESTIP, was therefore required to permit the development of these new technologies.

FESTIP is, in our view, a long-duration programme, since it is unlikely that the decision to develop a reusable launcher which complements Ariane-5 and its evolution could be taken before the year 2005. Europe has therefore ten more years to go and we do not start from zero, since we already have significant national works (such as

Hotol, Sanger, Prepha, Aeolus) to agree on the type of reusable launchers to aim for and to carry out the corresponding technology research, development and validation work.

Since we cannot predict the evolution of such technology developments, we have proposed to implement FESTIP in successive slices, each slice being short enough to allow to define our aim and long enough to achieve it.

A first slice of FESTIP was therefore proposed to Member States, called FESTIP 94-96. This first slice has a modest funding envelope (36 million accounting units at 1992 economic conditions, 36 MAU 92 for short). While this money is still insufficient for large-scale technology work, it is already quite adequate for in-depth study work.

The objectives of FESTIP 94-96 are:

- to create a consensus in Europe on which reusable launcher designs would be accessible to Europe and of relevance for its aims;
- to define the new technologies that will have to be developed to make such a reusable launcher possible;
- to begin with the basic technology development work whenever we could perceive its need and it fitted in the available budget;
- to prepare a reasoned proposal for the continuation of FESTIP beyond 1996.

When put up for subscription, the following ESA Member States decided to contribute to this programme:

—Germany, which funds 33.5 percent of the total envelope of 36 MAU 92
—Italy 15 percent
—Belgium 6 percent
—Spain 5 percent
—The Netherlands 4 percent
—Sweden 3.35 percent
—Austria 2.3 percent
—Norway 1.6 percent

The total of these contributions (70.75 percent) exceeded the minimum level of contribution of 70 percent initially selected as the lower limit for starting the programme, so that the programme came into being on 15 February 1994, the date at which the last Member State subscribed.

We then defined a plan of work to achieve the objectives of FESTIP by placing work with industries in the Participating States.

This plan of work consists of a coherent set of system and technology activities. The system activities were grouped within the FESTIP system study and the technology activities within five technology themes:

- Aerothermodynamics
- Materials
- Structures
- Propulsion
- Heat management

The FESTIP system study represents work for about 13 MAU 94 and is a large study by ESA standards. We have chosen DASA [German Aerospace] in Germany as the natural prime contractor and DASA then built up a comprehensive industrial team of sub-contractors (17 of them!). The DASA offer was evaluated by ESA during the Summer of 1994 and the negotiations were successfully concluded by September 1994, so that the formal contract kick-off meeting could take place on 4 and 5 October 1994.

The technology studies are at present in the definition stage and we expect to conclude the negotiation procedure by Spring 1995. We shall then have committed most of the funds available in FESTIP 94-96 and Industry will have two years ahead for doing dedicated work. During 1996, we shall prepare the programme proposal for the continuation of FESTIP and in the meantime we shall report in this bulletin on the technical progress of the work.

ESA Declares Committment to Participation in International Space Station

BR0704134895 Paris AFP SCIENCES in French 29 Mar 95 p 4

[Unattributed report: "Europe to be Active Partner in Alpha Project"]

[FBIS Translated Text] Paris—The European Space Agency [ESA] announced in a press release published on 23 March at the end of its 117th board meeting that Europe will be an "active partner" in the Alpha international space station.

European participation was confirmed in letters sent on the same day by ESA Director General Jean-Marie Luton to NASA Administrator Daniel Goldin and the directors of other agencies participating in the project (the Russian, Japanese, and Canadian agencies).

This confirmation which was expected—especially in the United States where discussions on the NASA budget are to begin in a few weeks—puts an end to the uncertainties surrounding this European participation in the project resulting from ESA's financial difficulties.

Europe's contribution concerns a pressurized laboratory module, the Columbus Orbital Facility (COF) hooked up to the station alongside Russian, American, and Japanese laboratories and living quarters. In addition, logistics services (cargo, fuel, etc.) will be carried on board European Ariane 5 launchers which will also carry an automated transport vehicle (ATV) to Alpha which will be used to boost the 51.6-degree orbit to 407 km altitude where the station will be developed.

The ESA press release does not mention the exact financial contribution for participation in the project. It merely states: "The board also accepted Mr. Luton's proposals to serve as a framework for preparing the final

decision which will be taken by the European space ministers at the council meeting in Toulouse on 18, 19, and 20 October 1995."

Mr. Jean-Marie Luton's new proposals concern an overall budget of ECU1.8 billion. The announcement of ESA's rapid decision was all the more surprising since the board meeting was scheduled to run until 24 March and it had been expected that the discussions between the delegations of the 14 member countries would be lively, especially on the financial level.

Now October's ministerial meeting has to be prepared and negotiations started with the other partners with regard to Alpha's running costs. Europe, and France in particular, which is one of the largest contributors to ESA together with Germany, would like to pay these costs in kind with Ariane flights and the supply of the ATV.

At the end of the ESA board meeting, Mr. Jean-Marie Luton said he was "convinced that much progress is being made toward defining Europe's commitments and toward bringing the whole process to a successful conclusion." As a result, he added, "Europe will be able to play an important role in this vast and ambitious international program."

The Alpha international space station project is currently at the development stage. Connection modules are already being built at the Boeing plant in Huntsville, Alabama. In the next few weeks NASA will conclude its tests in Houston on the new, fully computerized multimedia command center which will be used for flights to Alpha. The construction of the international station itself should begin in space, 407 km up, in 1997 with the arrival of the first Russian module financed by NASA.

All in all 13 launches of the Russian Proton rocket and 17 American space shuttle flights will be needed to assemble the station like a giant construction set until it is ready to welcome six astronauts in 2002. If all goes well the first occupants can arrive as of 1998.

Built from a series of modules assembled around a central beam where the Canadian robot system will evolve, the complete Alpha, with its solar panels fully deployed, will measure 90 m across and 60 m long. Its internal volume will be the equivalent of two Boeing 747's. It will cost at least $14 billion.

Ariane Flights Resume, Three-Week Launch Intervals Targeted

BR0704125495 Paris AFP SCIENCES in French 29 Mar 95 p 3

[Unattributed article: "Ariane Flights Resume: Hot Bird-1 and Brasilsat-B2 Launched Into Orbit"]

[FBIS Translated Text] Nearly four months after its seventh failed launch attempt last December, the European rocket Ariane successfully resumed operations and placed two satellites in orbit on 28 March at 2314 GMT. The satellites were EUTELSAT's (European Telecommunication Satellite Organization) Hot Bird-1 and the Brazilian company EMBRATEL's Brasilsat-B2.

The provisional orbital parameters provided by the 71st Ariane rocket are excellent: 198.8 km at the perigee instead of the targeted 199.7 km and 36.048 km at the apogee instead of the 36.017 targeted, and a 7-degree inclination as planned.

Arianespace CEO Charles Bigot announced that the next launch of the European earth observation satellite ERS-2 was planned for the third week in April, around the 20th. He said he was convinced that if everything went according to plan Ariane launches could take place at the rate of one every three weeks and that Arianespace and the teams at the Kourou Space Center in Guiana would be able to keep up this rapid pace.

The placing in orbit of Brasilsat-B2 came nine years to the day after the launch by Ariane of the first Brazilian satellite. Built by Hughes Space and Communications (United States) and weighing 1.780 kg at launch, Brasilsat-B2 should guarantee classic telecommunications services (telephone, television, telex, data transmission) throughout Brazil, Paraguay, Uruguay, and Argentina, all members of Mercosur (Mercosul for Brazilians) the South American common market, for 12 years from its position in geostationary orbit 65 degrees west, in other words over the Atlantic Ocean.

Hot Bird-1 is the sixth of EUTELSAT's second generation of satellites built by a consortium led by Aerospatiale and is entirely devoted to live television. It is due to provide TV programs to the whole of Europe as well as to Mediterranean countries for 12 years from its orbital position 13 degrees East, in other words over Africa. The placing of this satellite in orbit responds to growing needs and EUTELSAT, which lost a satellite with the failed Ariane launch on 24 January 1994, has been waiting since then to beam a wide range of channels into nearly 50 million European homes.

With the signing of the contract to launch the PAS 3R satellite belonging to the American private television station Panamsat whose previous satellite ended up in the Atlantic after Ariane's failed 70th launch on 1 December 1994 and the contract to launch EUTELSAT's Hot Bird-3, Ariane rockets are due to launch 38 satellites representing over 17 billion French francs.

France: SPOT Image Preparing 5-Meter Resolution SPOT 5

95WS0188A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 59

[Article by Gerard Brachet: "Key Year for Satellite Imaging"; introductory paragraph in italics as published]

[FBIS Translated Text] *Gerard Brachet is chief executive officer of SPOT Image, a CNES [National Space Studies*

Center] subsidiary that was established in 1982 to market images taken by French SPOT observation satellites.

At the end of this February, the first French SPOT observation satellite will celebrate its ninth year in orbit, and early in May the SPOT Image Company will celebrate nine years of operation in which it has developed the market for satellite imaging.

The market, which is still in a takeoff phase today despite the great breakthroughs achieved in mapmaking applications and in inventorying agricultural resources, is beginning to attract the covetous attention of large U.S. groups convinced that the race for space resolution will cause that market to explode.

The reasoning is simple: if SPOT, with its 10 meters of ground resolution in panchromatic mode, can do almost twice as much business as U.S. LANDSAT satellites with their resolution of 30 meters ($40 million (220 million francs [Fr]) compared to $20 million), then satellites capable of producing images with a resolution of 3 meters or even 1 meter should easily be able to capture from three to five times as many customers.

Reality is not all that obvious, however. Besides the real political problems posed by the market for very high-resolution imaging, the image-capturing and production capabilities of the new imaging satellites are a decisive factor. We have seen this in the case of the Russian reconnaissance satellites, whose impact on the market is marginal despite their high resolution (2 meters in the case of the KVR-1000 camera).

The truth is that what the market needs is not a frantic race for space resolution but observation capability, reliable acquisition circuits and equipment, and a delivered product better suited to the user's requirements.

In that context, 1995 is going to see two major events take place.

One is the start of construction on the SPOT-5 satellites that were approved by the French Government on 4 October. Around the end of the century, they will provide the "operational" stereoscopic observation capability long desired by the market: an observation capability increased by 50 percent (three telescopes instead of the two on the current SPOT satellites) and improved ground resolution (5 meters in panchromatic mode and 10 meters in multispectral mode) without sacrificing the field of view, which remains at 60 km.

Moreover, Canada is scheduled to place the first operational radar imaging satellite (RADARSAT-1) in orbit this year. The resolutely operational and commercial purpose of that first satellite, unlike the strictly experimental objectives of the European satellites ERS-1 and ERS-2, will make it possible to measure the impact of all-weather radar imaging on the market. Such imaging is not limited by the presence of cloud cover, but on the other hand, interpretation for use in the most developed applications is less easy than in the case of traditional optical images.

In the long run, it is very probable that an intelligent combination of optical images and radar images, either in the form of mixed products or by the superimposition of data extracted from both types of imaging, will make it possible to serve the market in excellent operational and commercial conditions and to satisfy most needs for geographic information.

From that standpoint, the period from 1995 to 2000 will be decisive in testing the market's reactions to these new products and services. SPOT Image is already investing a lot of effort in that direction, and in coming years it will confirm the capacity for initiative that has already enabled it to take first place in the world market for satellite imaging.

France/Italy: ATR Head Discusses Company's Regional Jet Programs

95WS0174A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 23

[Interview with Henri-Paul Puel, general manager of Franco-Italian ATR, by AIR & COSMOS; place and date not given: "Puel Sees Bright Future for Regional Turboprop"]

[FBIS Translated Text] *ATR hopes to strengthen its position in Europe and play an important part in the Asian market. Henri-Paul Puel is general manager of the ATR (Regional Air Transport) economic interest group (GIE) formed by Aerospatiale (France) and Alenia (Italy).*

[AIR & COSMOS] When will the ATR 82 and ATR 100 come out?

[Puel] We are working with our partners Aerospatiale and Alenia to move our line toward the "high end," our spearhead being the ATR 82, whose launching depends on the addition of a third partner to the Franco-Italian joint venture, and on the results of the market research we are conducting.

In the 100-seat category, we will just have to see. Our top priority is the 82-seater, where we think there is a market for 300 aircraft.

[AIR & COSMOS] Do you see the regional aircraft market gravitating toward jets or toward propeller-driven planes?

[Puel] This question is not new but is increasingly being discussed. Indeed, some airlines that in the past were using turboprops have recently decided to introduce regional "jets" into their fleets, for they've seen a market there.

Fifty-passenger regional "jets" can cover distances of 740 km (400 nautical miles) in an hour and a half. This characteristic makes it possible to open new direct

interregional routes without connecting through congested international airports or putting larger-capacity jets (100-passenger aircraft) on routes where they cannot be justified financially or in terms of frequency. ATR for its part has opted for turboprops, based on the characteristics of the market and the fact that our clients consider there will always be a place for this type of craft. Because, from an economic standpoint, they are unbeatable on 460-km (250 nautical mile) runs, where their direct operating costs are 25 percent lower than those of a regional jet. On such routes, and for much less cost, the difference in speed is equivalent to only 5 minutes' flying time.

Now operational efficiency is important to our clients, but there is also the comfort factor because, as far as passengers are concerned, "jets" set the standard in this domain.

[AIR & COSMOS] How is the ATR 42-500 coming?

[Puel] With the ATR 42-500 we have a high-performance aircraft that is also very comfortable and economical. This craft, which will be introduced at Le Bourget Air Show, will offer noise and vibration levels equivalent to those of a comparable jet. There will be new cabin decor as well as the biggest baggage compartments available in any aircraft of its class. All these improvements will also show up in ATR's other models early in 1996.

Performance has also been taken into consideration, as the ATR 42-500 will cruise at speeds of over 300 knots (560 kilometers per hour), while costing a lot less to run than a "jet." Operators choose "jets" when their concern is to expand their network and market radius. The short-range regional transport market remains basically oriented toward the turboprop, for obvious economic reasons.

[AIR & COSMOS] Do you have plans for any alliances or mergers?

[Puel] ATR's leading position has always excited much envy as well as overtures for cooperation. The Franco-Italian joint venture is a fine example of such cooperation, and ATR shares with other manufacturers in the sector a desire to pool our increasingly sophisticated resources to meet demands for ever more advanced, high-performance craft. The turboprop industry has not yet had its revolution. It is still encumbered by too many obsolete products. It goes without saying that ATR would like to see a consolidation around its own family of products.

[AIR & COSMOS] How does the market for the year 2000 look?

[Puel] I think we must get past the jet-versus-turboprop debate, because both have their place in the regional transport market. The former is worth the investment on routes that are longer or different from those of the turboprop, which is limited to flights lasting 45 to 90 minutes.

In the future, we will have several important things going for us, thanks to the ATR 42-500 and the ATR 72-210, which meet four major criteria, four current market demands: commonality within a family of aircraft, operational efficiency, performance, and comfort.

Market demands in the year 2000 will still be oriented towards the ever-present concern for profitability and the need for greater comfort. We expect our own market share to remain at around 50 percent, in terms of aircraft for 40-70 passengers.

[AIR & COSMOS] What about production and orders as 1995 opens?

[Puel] Our production capacity must take into account the needs of the market and show flexibility and adaptability, because there's no guarantee this year that all the aviation companies are going to make it through the recession. In 1995, we must strengthen our position on the European market.

For the coming years we anticipate considerable growth in the Asian market, where we definitely plan to play an important part. Already ATR are being flown in Taiwan, Vietnam, Cambodia, Laos, and Myanmar.

Results of EUREKA Project on Lighter Materials for Cars Viewed

95WS0256A Duesseldorf HANDELSBLATT in German 8 Mar 95 p 38

[Article by Stefan Schlott: "Building Lighter Cars Could Become Expensive"]

[FBIS Translated Text] **The marketing strategists at the materials producers who are fighting for market shares must come up with new arguments, because neither steel nor aluminum, nor plastics, achieve the touted light construction potentials under conditions of mass production. This is one of the most interesting results of the EUREKA [European Research Coordination Agency] research project "Mosaic," which was recently presented at Renault.**

For four years the French steel manufacturer Sollac, the plastics suppliers DSM, Enichem and Montedison, the adhesives division of Ciba and Hydro Aluminium Automotive Group worked on the project of this European research initiative under the leadership of Renault. The objective was to save, by means of new materials technologies, at least 30 percent weight in the small Clio car which rolls off the assembly lines in daily numbers up to 1,800, without sacrificing quality and safety. At comparable cost, of course.

In order for the first time to meet all the specification requirements of an existing vehicle model through alternative approaches, at times up to 70 vehicle developers from five countries took two routes: One prototype was reserved for the use of optimized steel applications. As the second approach a hybrid solution was chosen, in which the steel was replaced by light metal alloys and fiberglass-reinforced polymer compound materials.

In order to state it at the outset: The ambitious goals were not reached with any of the variants. At the concluding presentation, project spokesman Henri Mathiolon estimated the light construction potentials that can be achieved with steel material to be a "maximum of 10 percent." For the modified Clio this means an 18-percent ratio of sandwich plates (bulkhead, central and rear floor group, rear wheel boxes) as well as greater use of highly elastic steel plates. These make lower sheetmetal thicknesses possible due to their greater strength.

The sandwich plates involve two thin layers of steel which are held together by an approximately 50-micron-thick polymer film. Their high vibration-damping coefficient makes heavy insulating materials practically superfluous. Additional reduction in weight is achieved by using epoxy glues for steel sheets that were used as a substitute for 25 percent of the welded connections.

To Mathiolon this steel variant is "a promising perspective," since conversion of the production facilities is not really necessary. And: "The material costs for the highly elastic steel and sandwich sheets will be offset by the elimination of insulating materials and the simpler assembly process."

The attempted 30-percent lower weight brings the hybrid solution of the second prototype into consideration. To be sure, in large-scale manufacture the costs would be up to 60 percent higher. The focal point is an aluminum space frame, similar to the Audi A8, a floor group of fiberglass-reinforced compound materials and aluminum sheetmetal for roof and rear window frame. The space frame involves a framework of extrusion-molded aluminum profiles, which in a second step are "panelled" with the exterior skin.

Hybrid Solution 30 Percent Lighter

The clearly higher cost of materials for the light metal is held responsible for this cost explosion. But there is also the fact that the distinctly lower tool costs with the extrusion technique and the less expensive assembly technology for the space frame really take a plunge in large-scale manufacture.

Says Mathiolon: "For that reason a medium-term implementation of the concept is possible for niche vehicles or small-series variants. Large-scale application is only conceivable in the long term and gradually." Incidentally, at the Geneva auto salon Renault will present such a niche vehicle based on the Mosaic results. The new Renault Spider is to be made of a modularly constructed body frame of extrusion-molded aluminum profiles and a synthetic skin and thus will be not only extremely light but also very safe.

Finally, the concluding Mosaic report nevertheless represents a positive sign for the aluminum advocates as regards passive safety. What until now could only be guessed at, and repeatedly created wild speculation, was proven in real crash tests within the framework of the research project: The Clio hybrid version with a front block and passenger compartment of aluminum profiles achieved the best values in frontal crashes at 50 km/h. Thanks to specific local heat treatment of the profiles and the installation of geometric "triggers," the dynamic deformation was 20 percent below a conventional Clio and the passenger compartment remained undamaged.

While aluminum suppliers such as Norwegian Hydro Aluminium or U.S. Alcoa continue to search for new small-series vehicles for their space frame, the golddigger atmosphere in the magnesium industry is intensifying to a veritable "run" and more and more suppliers are jumping on the "magnesium bandwagon."

Magnesium is the lightest construction material that is used today in the automobile. Since the few still lighter metals are all too unstable chemically and, in addition, have limited availability, this will remain so as well. With a density of only 1.8 g/cm^3, magnesium is about 75 percent lighter than steel and 30 percent lighter than

aluminum. The elasticity module per weight of magnesium is approximately equal to that of steel and aluminum; the density-per-weight ratio is even higher than that of steel.

Run on Magnesium

Structural parts of magnesium are today produced exclusively with casting technology. Primarily the die-casting method plays an important role. Thus, very strong, complex, thin-walled structures with an acceptable surface are being created, which can be worked and welded using the appropriate alloys.

The outstanding casting properties of magnesium permit the production of highly complicated parts, into which many additional functions can be integrated. In addition to saving weight and reducing the multitude of parts, greater productivity in assembly can also be achieved.

The field of casting, above all, has moved into focus since the magnesium producers uniformly report a tremendous wave of demand. John Ottestadt, for instance, president of Norwegian Hydro Magnesium, one of the largest suppliers in the world, expects a worldwide growth of 15 percent annually. In order to be ready for the corresponding processing opportunities, an international consortium of companies now plans a magnesium foundry in northern Italy, which all at once will double the casting capacities in Europe.

Smaller suppliers as well have long since smelled danger. Paul Zitzmann GmbH & Co KG in Stockheim in Franconia, for example, until now known as a specialist in tricky parts from zinc die-casting, is now establishing another cornerstone with magnesium casting. Business manager Mattias Zitzmann expects that as early as this year the projected sales growth will come primarily from the new magnesium activities.

Aluminum Replaces Steel

Meanwhile, there will be no substitution struggle between magnesium and aluminum, market observers believe. On the contrary; the use of both materials will continue to grow independently of each other. Usually at the expense of steel. Even today, in addition to the usual casting applications, aluminum competes with steel in the body field.

Magnesium, on the other hand, will find increasing use in components where weight is more important than cost, and in which production-economic factors favor the use of one metal. Examples are thin-walled, complex cast parts, such as various caps and housings, or highly integrated structures such as equipment mounts, pans and door frames.

France: Latest Automotive Industry Developments Analyzed

PSA Peugeot

95WS0264A Paris L'USINE NOUVELLE in French 23 Feb 95 p 35

[Article by Christiane Perruchot: "New Jobs for the New Peugeot"]

[FBIS Translated Text] **The model replacing the Peugeot 405 is going to create 1,500 jobs—not in Peugeot itself, but with subcontractors building facilities on its doorstep...**

Preparations for the new Peugeot destined to replace the 405 are giving an economic shot in the arm to the heart of the Montbeliard country. No fewer than 1,500 jobs will be created, over the next three years, in the orbit of PSA's production center at Sochaux. One by one, equipment suppliers Reydel, Treves, Reinshagen (General Motors), and Valeo have announced plans to move to the Etupes industrial zone, less than a mile from the Sochaux plant. And that's not all. Owing to use of "just-in-time" production input methods, more equippers are expected to build in the vicinity of the auto maker's assembly lines.

No Giving Up

The urban portion of the Montbeliard country and its 121,000 inhabitants are undergoing a veritable cultural revolution. In 15 years, manpower at the Sochaux production center has dropped to under 20,000 from a July 1979 peak of 42,000. As a result, the Montbeliard labor pool has seen its unemployment rate (11.2 percent) increase by 8.4 percent in a single year. But there's no question of throwing in the towel. The automotive industry hub at Montbeliard is getting all possible support from the Doubs community.

With encouragement from PSA and its purchasing center, Sogedac, a Law 1901 association headed by a former Peugeot engineer was created in July 1993. Its aim: to promote job creation, offsetting losses in direct employment by inducing equipment suppliers to move their production sites to the area. "For the moment, we are only working at Montbeliard, because it is there, owing to reduced sales of the 405 and 605, that jobs have been most affected," says association president Fernand Bonnald. Equippers Treves SA and Reydel have gone in together on a 50-50 basis to create Tredel, a joint-venture production subsidiary. These specialists in auto upholstery and door interior fittings have pooled their expertise in order to offer specially tailored service for the new model. The insides of the doors, on this new model, will be molded by thermocompression using a Reydel technology. Treves, for its part, is contributing its synchronizing techniques. Via a Transpac [data transmission]

link, the factory, currently in the pilot production phase, stays in continuous communication with the builder. Car doors are fabricated and delivered by truck as needed to feed the assembly line. "Everything is done with split-second timing; it takes us 210 minutes to supply the parts for 18 vehicles, and we have only 5 days' worth of buffer stocks in case of a slip-up," says Bernard Gaulier, site manager. The statistics: 67 jobs in March, 150 by the end of 1995, and an investment of 100 million French francs [Fr].

Reinshagen, a world leader in the wiring field, is also building a unit in the Sochaux area. It will manufacture some of the wiring packages; the rest Peugeot will manufacture in-house. This facility is expected to entail creation of 310 jobs and an investment of Fr50 million.

"But we don't want any exclusivity with respect to subcontractors we encourage to come here," says the president of Peugeot Development. Take the case of Trevest, a fully-owned subsidiary of Treves that has decided to collocate in Etupes its previously dispersed facilities for fabricating head-rests, arm-rests, and window casings using injection technology. The Fr75 million investment, which should generate 400 jobs between now and 1997, will also benefit many other auto makers.

Local Committee

Valeo, a partner in a joint venture with Japan's Seiko-Seiki, is another equipper not content to stay in the shadow of the [Peugeot] lion. The Montbeliard country beat out Italy and Scotland for a Fr320-million project: a 9,000-square-meter factory (the first phase will be 5,500 square meters) to manufacture air-conditioner compressors for all of Europe. The objective is 6 million units in 1996 with 330 employees, including 250 in the production department.

These projects would never have come to fruition but for a perfect meshing of interests of all the local partners. A local development committee created last February has been formed to "avoid duplication in the search for investors." It also promotes better coordination of assistance, from real-estate subsidies to regional development incentives. Also, to avoid destructive competition among themselves, the district of Montbeliard and the towns of Belfort and Hericourt in the adjoining department have decided to share the community portion of occupational tax revenues from three of their activity hubs.

Renault's R&D Center

95WS0264B Paris L'USINE NOUVELLE in French 23 Feb 95 pp 46-49

[Article by Odile Esposito and Michel Vilnat: "A Technology Center for Quicker, Less Expensive Production"]

[FBIS Translated Text] **By converting from sequential to interactive work methods, the Guyancourt center will save Renault more than Fr1 billion per model. It will also serve to test the new flexible assembly method the builder has recently adopted...**

More than twice as expensive as the Normandie bridge and almost as costly as the Very Large Library: Renault has spared no expense in building the ultramodern technical center where its future vehicles will be designed from start to finish. With 350,000 square meters of buildings on a 150-hectare site, 20 km of private roads, and 50 km of fiber optic cable for data processing, the Guyancourt Technocenter (in the commune of Saint-Quentin-en-Yvelines) represents a total investment of Fr6.4 billion. Scheduled for completion in 1998, the year of Renault's centennial, the center by then will accommodate 6,300 technicians and engineers and a thousand representatives of equipment contractors.

"But this project is not just a monument to vanity," opines Philippe Gras, deputy general manager. "Let's not forget, company turnover in 1994 was almost Fr180 billion." Initially Renault had even larger visions: It also planned to bring the 3,500 personnel in "mechanical systems" (motors and transmissions) to Guyancourt. "But we were afraid a 10,000-person center would simply be too gigantic," Gras explains. "Mechanical" will thus stay in Rueil, in Hauts-de-Seine.

Renault hopes to quickly recapture the billions it is investing. Research and development costs are higher every year. Today they represent 17 percent of the enterprise's outlays, and the builder is trying to optimize them. "We expect this Technocenter to generate a profit of Fr1 billion per year for the enterprise, meaning profitability on the order of 15 to 20 percent," says Gras. How? By drastic savings in time and costs, at all levels, in design and fabrication.

[box, p 46]

Prototype Production Center

The assembly shop in the photo [not shown] will be one of the key elements in the prototype production center. In this 47,000-square-meter building, 600 people will build full-scale prototypes at the rate of three or four per day. It will be equipped to test pilot production assembly methods, so they can be improved to speed up industrialization in the manufacturing plants.[end box]

[box, p 46]

Financing

It will be several more years before Renault owns its new Technocenter outright. To avoid going into debt, the builder decided to go to the banks—beginning with Credit National and Credit Commercial de France. Renault shelled out Fr1.3 billion; the other Fr5.2 billion will come from a real property company owned 85 percent by the banks and 15 percent by Renault. The contract gives Renault the right to buy back the banks' shares in the year 2000. Between now and then, Renault

counts heavily on being able to sell its land holdings in Boulogne-Billancourt for a good price.[end box]

Saving Time

Reduction of design time has become a major objective in the auto industry worldwide. It used to take 58 months, sometimes as long as 10 years, to design and industrialize a new automobile; Renault has already compressed that period to 45-49 months, depending on the model. Its goal: no more than 38 months between the time the vehicle platform is chosen—with a clearly defined architecture and two or three interior and exterior design possibilities—and the time the vehicle is put into production.

To meet that goal, Renault has been systematically reorganizing its work teams. Tested in the designing of the R19, the "deck teamwork" method, in which design and industrialization engineers work together and with representatives of 200-300 major suppliers, has since been implemented almost company-wide. In the structural reorganization that went into effect last July, research and methods were merged. That is, research teams and methods teams from the various factories were attached to the central methods directorate.

The goal: to replace traditional sequential work, which often leads to costly last-minute modifications, with interactive work. "This revolution has broken with practices that were in effect for decades, but it cannot succeed if teams continue to be dispersed over dozens of different sites," Gras explains.

[box, p 47]

La Ruche

In an area of 140,000 square meters, 4,100 people, including several hundred representing outside companies, will do research on products and processes. The space will be modularized into various project "decks." The laboratories, test beds, and mock-up facilities will be on the ground floor of this immense building.[end box]

[box, p 47]

Avancee

This building, which will cover 74,000 square meters, will accommodate 1,400 people. Design, with its research offices and design and mock-up studios, will occupy the west side of Avancee. The technical strategy directorate as well as the advanced research and preliminary studies teams will be installed on the upper floors. A 300-person conference center is also planned.[end box]

[box, p 47]

3-Year Completion

1 June 1995: delivery of first bloc of 60,000 square meters including the Prototype Production Center and the power and fluids plant.

End of 1996: delivery of 100,000 square meters including Avancee and the logistics building (maintenance and storage).

1998: delivery of 190,000 square meters including Ruche.[end box]

Hence the interest in this Technocenter, a veritable mirror of the new organizational structure. Not only Avancee, where design, research, and development teams will be concentrated, but above all the huge, 142,000-square-meter Ruche building, which will facilitate direct communication between project teams, systems specialists, and equipment suppliers. "In our Latin cultures, nothing replaces contact," argues Philippe Ventre, director of vehicle engineering. "The design process can't all be done by e-mail."

Miniature Factory

But Renault is not neglecting the role of computers. "We can't cut lead-time to 38 months without advances in computer simulation," Ventre insists. "These days our engineers may work for a whole year on models and virtual images before the first prototype is produced. Which allows them to study and adjust things on screen, even including the manner in which assemblage will be performed." By simplifying assembly, the builder hopes to save more time. Its objective: reduce assembly time from 20 to 15 hours.

Thanks to the Technocenter, this race against the clock will rapidly change the factories too. "Currently, when production of a vehicle gets under way, it takes 8 months before we're fully up to speed," says Ventre. "Our objective, by 1998-1999, is to be up to speed in 1 month." To accomplish this, Renault is relying on the Prototype Production Center (CRP), a vast, 47,000-square-meter building which with its relatively few windows is protected from the gaze of indiscreet eyes. The CRP is scheduled for completion in June and will be operational by next September.

The CRP will function as a veritable miniature factory, able to fabricate three or four vehicles per day, to permit full-scale testing of assembly operations. Vehicles produced by this center will be built under conditions identical to those that will obtain in mass production—conditions that can be transposed directly to the factory. Up to now, each factory had an area reserved for refinement of advanced prototypes and pilot production models. Thanks to the CRP, Renault can free up that space in factories for other uses and avoid the need to relocate hundreds of design team members to production sites when production of a new model gets under way.

Reducing Costs

Saving time means saving money. Here again, Renault has set precise targets. "We expect the Technocenter to save Fr1-1.5 billion on the cost of designing each new vehicle," says Gras. "The 'entry ticket' for designing a

new vehicle is about Fr4.5 billion," explains Ventre. With its Twingo, which cost only Fr3.7 billion thanks to its extreme simplicity, Renault came in well under the usual tab. But the Laguna, with its multiple versions present and future, devoured some Fr9 billion. And from model to model the price tag just gets bigger.

Regulatory constraints (reduction of pollution, fuel consumption, noise level, etc.) add more to the cost. So do customer demands for safety and quality. The level of sophistication has exponentially increased design costs. Not so much in personnel (gray matter) as in the substantially increased cost of building prototypes. Gone are the days of hand-crafted manufacture and piece-by-piece manual assembly! Today's prototypes are built with modern tools (multi-axis digitally-controlled milling machines, etc.) and assembled almost like mass-production models. These advances, which yield very high-quality prototypes and facilitate faster industrialization, have also substantially (and irreversibly) bumped up development costs. "The Fr1 billion per vehicle we save will make it possible to build more sophisticated vehicles on a constant budget," Ventre predicts.

[box, p 48]

Gigantic Work Site

The Guyancourt Technocenter is also a major construction project. Renault estimates construction will ultimately entail Fr4.5 billion in some 2,000 contracts (contract add-ons and work for subcontractors included). The other Fr2 billion consists mainly of equipment to be ordered by the group's purchasing directorate. More than half the 700 principal contracts have already been signed, and another 500 are expected to be concluded before the end of the year. In particular, all the contracts for building structures are already in place: General Building and Construction Company and Industrial Enterprise for Ruche; JAF for Avancee; Quillery, Eiffage, and SAE Fougerolles for the CRP. The road network will be built by Screg, Cochery-Bourdin, and Jean Lefevre. Construction will involve some 300 enterprises and require 25 million man-hours of work: 10 million on the work site itself, and 15 million more in downstream manufactures (facades, partitions, carpeting, etc.). Some 1,200 people are currently at work on construction, but the number employed is expected to grow to 2,000 or more before the end of 1995.[end box]

The war against costs is not limited to vehicle development. Renault also hopes to use the Technocenter to test a new concept of sheet-metal assembly. What's that about? No more nor less than the development of flexible assembling machines that can be adapted to all future vehicles of the same gamut. "Currently, at Sandouville, our Safrane assembly line has excess capacity, while at the same time we can't build enough Lagunas," explains Ventre. "Unfortunately, we can't assemble Lagunas on the Safrane line." It's this lack of flexibility that Renault wants to overcome, with the help of its subsidiary, Renault Automation.

Flexible Assembly

The idea is simple, though highly complex to implement. "We tested it earlier on the R11, at our Douai plant," Ventre recalls, "but we never followed up on the experiment. Going this route imposes a significant constraint on vehicle design: The auto body must be stamped out identically for all its various models." Which is far from being the case with current product lines. Today, for example, Twingos are assembled at four different assembly stations; in Laguna, at only one. Renault didn't pursue the idea, but it was not lost to the world. "The Douai site attracted a lot of Japanese visitors, especially from Toyota, and the idea came back to us from Japan," Ventre continues. After 18 months of vacillation, back-and-forth between the various offices concerned, and number-crunching, the decision was finally made late in 1994 to adopt the flexible assembly principle for new models produced beginning in 1997.

The savings are mouth-watering. The initial investment for putting a new model into production works out to some hundreds of millions of francs. In order to adapt a given vehicle's flexible assembly line to a second vehicle, all you have to do is adapt the pallet adjustment system, which can easily be done in the CRP's mini-factory before the transfer to mass-production plants. "This means the assembly investment required for the second vehicle will be only 40 percent of the initial investment. A savings of 15 to 20 percent on total production investment, and a savings of 5 to 10 percent on the total 'entry ticket,'" Ventre says. "What's more, going this way makes us less the prisoner of specific sites."

Additional Hurdles

To save time and money, Renault has opted for draconian solutions. What's left now is to bring the whole thing to life. Beyond the normal problems associated with relocation and start-up for any new installation, Renault will have to deal with several problems more specifically tied to the nature of the Technocenter.

In abandoning for now the idea of bringing "mechanical systems" personnel to Guyancourt, the builder is separating teams that up to now have worked together. "We will certainly have to structure the working interface between mechanical and the Technocenter," Ventre acknowledges. "Mechanical will have to move increasingly into the role of being a supplier. This is a situation with which we already have some experience, with La Francaise in engineering."

Also, the Technocenter will have to learn to coordinate its work with the testing centers at Lardy and Aubevoye. Guyancourt will have plenty of its own laboratories and several acoustical and vibration testing facilities, but no climatic testing facility is currently planned there.

A final difficulty, created by the very size of the center: coordinating the work of the various teams, in particular the extremely complex process of guiding the vehicle design planning process. To manage this problem, Renault may need to turn to builders that already have experience with technical centers of this type: BMW, and above all Chrysler.

The Technocenter, which Louis Schweitzer called "an architectural translation of a new organization," offers Renault an extraordinarily advanced platform. It remains now to bring it to life without too much trauma.

[box, p 49]

Expertise Concentrated

The Guyancourt Technocenter will bring together teams currently dispersed at sites all over the Paris region:

- 2,000 from Rueil, which will be the site for all engine and transmission activity, currently divided between Boulogne and Rueil;
- 2,000 at Boulogne-Billancourt;
- 600 at a temporary site in Saint-Quentin-en-Yvelines, already working as project teams;
- 1,700 people working at forty or so various sites;
- 1,000 representatives of outside companies, equipment suppliers working on projects under way.

[end box]

Germany: Thyssen Official Discusses Berlin-Hamburg Maglev Line

95WS0287A Duesseldorf VDI NACHRICHTEN in German 17 Feb 95 p 35

[Article by Lutz Bloos: "Hamburg Area Association Discusses the Transrapid Project. The Berlin-Hamburg High-Speed Maglev Railway Cleared for Takeoff"; first paragraph is an introduction]

[FBIS Translated Text] **Hamburg, 17 Feb 95 (VDI-N)—The Hamburg Area Association presented up-to-date information on the Transrapid project and the planned Berlin-Hamburg maglev railway line.**

The topic "Transrapid" at the University of the Federal Armed Forces, to which the automotive and transportation engineering study group of the Hamburg Area Association sent out invitations, turned out to be a locomotive for the public. An audience of over 150 almost completely filled the seats of the auditorium as Luitpold Miller, head of the systems development main division at Thyssen-Industrie AG [Thyssen Industries, Inc.] in Henschel, began his lecture with a film, studded with computer animation, that presented the Transrapid vehicle and the Hamburg-Berlin line. Those who still faced the new technology with skepticism were electrified by the enthusiasm with which Miller praised "his" product.

He divided the praise for the maglev railway into three areas: the technology, the system properties and the Berlin-Hamburg line. For it turned out well that not only had the Bundesrat [upper house of the federal parliament] approved of the project, but also Magnetbahn Planungsgesellschaft mbH [Maglev Railway Planning, Ltd.] had been founded beforehand. This gave the speaker additional momentum that could not be slowed even by critical questions about technical details and the system's safety.

On the subject of safety Miller explained in detail that opportunities for getting off are to be constructed approximately every 10 km on the Hamburg-Berlin line. In the case of a breakdown, which there really could not be with this technology, the train would float even without motive power to the next exiting point, where the passengers would then be picked up. Even if the magnets that keep the train floating should fail, not much can happen to the train passengers. In this event the train drops approximately 10 mm and continues to slide on the supporting frame, whereupon it is slowly braked. Accordingly, tests have been run on the test line in Emsland.

The fact that the system was considered technically perfected although it has covered only 200,000 km caused opposition in the professionally competent public. New car models have to be driven at least 20 times this distance before the car maker can put them on the market. But even this objection could not mar Miller's optimism. The wish has not been to "burn up kilometers," he said, but the technology and system have been tested and improvements made again and again in order with the Transrapid to lead the development of maglev technology at the international level.

Miller also considers it relatively easy to solve the problem of initiation in downtown Berlin and Hamburg, which has been discussed by the public as highly problematic from the city planning viewpoint. The ideal possibility would be for the railroad to make available for the Transrapid two tracks in the respective railroad station areas, and for the roadway to then be constructed on the route of these tracks. This is feasible for the reason that the maglev line fits into the railroad's train profile. There are even technical possibilities of constructing the roadway for a dual purpose, i.e., of furnishing it with rails for ordinary trains. Switching would be rather complicated then, but definitely masterable technically.

Miller thinks it is possible to keep to the timetable, and is also not figuring on substantial delays because of protests or political exchanges of views. To the exchanges of views talked about in the Hamburg SPD [Social Democratic Party], he said to VDI-NACHRICHTEN, "I see no problem there. Hamburg has still given its approval in the Bundesrat." True. But Hamburg's burgomasters were already disgusted for lesser reasons by their party from the department. One could read in the Hamburg newspapers one day after the

public lecture that First Burgomaster Henning Voscherau threatened his resignation because of the exchanges of views concerning the Transrapid within the party. So, the Transrapid has not pulled out yet.

Germany: Error by Siemens-Supplied Computer Halts Train Traffic in Hamburg

95WS0294B Munich COMPUTERWOCHE in German 24 Mar 95 p 27

[Article: "Siemens Computer Cripples Signal Box in Hamburg for Two Days"; Subheadline: "German Railway Mulls Claim for Compensation"]

[FBIS Translated Text] **Hamburg—Between Monday and Wednesday morning last week all signals at the Hamburg-Altona railway station were on stop. As in the startup years, switches could be thrown only by means of switch wrenches the size of a crowbar. The culprit was a glitch in a Siemens computer that had been placed into service the previous day.**

The Hamburg-Altona is a hangout for pigeons and gulls. For nearly three days they could hunt unperturbed among the tracks for something to eat and use the powerlines for their antics. As of the early hours of 13 March 1995 the digital control box was out of service: Siemens' master computer was down following a glitch in the working memory.

The morning rail traffic was rerouted: ICE [intercity express] and IC [expansion not given] passengers could still be brought to the main station, for all others the trip before the gates of Hamburg was over—in the south at the Harburg station and in the north at Pinneberg station. Anyone wanting to go further had to transfer to the subway. Only this expedient made it possible to keep rail traffic moving at all. Delays of as much as 40 minutes, however, were unavoidable.

Even on Wednesday, when the computer was back in operation, long-distance trains were departing the Hansa city with a 20-40 minute delay. Over the three days one out of five long-distance trains throughout Germany failed to arrive on time. The ICE flyers had to be steered from their operational mechanism in Eidelstedt north of Altona via a shunt rail to the main station. At press time it had not yet been determined whether the railway will sue for compensation. According to a railway management spokesperson in Hamburg, they are reserving their right to legal action.

Siemens Data Processing Cost Railway 40 Million Marks [DM]

In this context the railway was exceptionally proud of its digital assistant—in the in-house newsletter "The Train," a report was specifically devoted to it. The total cost of the new technology was DM62.6 million, two thirds of which Siemens pocketed. The Siemens computer replaces eight conventional control boxes deriving from the period between 1911-1952. It controls all switches and signals in the region of the railway station. Should it fail, all signals stay on red and any longer the switches can only be thrown manually.

In Altona, for the first time, use was made of a Simis-3216 computer having Intel 486 processors. Siemens renders such systems exceptionally durable: they tolerate temperatures between minus 40 and plus 85 degrees Celsius as well as impacts five times the velocity of the earth. Even unwanted signals of 2,000 volts have no influence on the operation in progress. For security, the computers are run in a two-out of three combination, meaning that three identical computers are on site, of which one alone is capable of handling the tasking in the control box. Two computers run continuously in parallel so that if one system fails it is possible to switch directly to one of the standby pieces equipment. In the event of such a failure the third system is then brought on line so that in a few minutes normal operational security is once more realized. When everything is running the way it should, the two working computers mutually monitor each other; only if both systems realize the same result is any command executed.

In the search for the cause of the computer crash with its serious consequences a hardware flaw could be ruled out. Even the system software was working without a glitch. The automatic shutdown instead was attributable to a planning error: the computer's working memory was not capacious enough; it was inadequate once events (= trains) and switchings piled up. That critical point was passed already on Monday during normal rush-hour traffic. The computer was unable to continue operating any longer and automatically shut itself down.

It took two days, however, for Siemens technicians to pursue and analyze the situation at their Braunschweig test center. Only by 5:00 a.m. on Wednesday was the computer back in operation and at about 2:00 p.m. rail traffic via Altona was once more running smoothly.

Germany: Cancer Remedy Exhibits Fewer Side Effects

95WS0267B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 17 Mar 95 p 8

[Article by "nrb": "Anticancer Drug With Fewer Side Effects. Better Tolerance Because of Substitution of Nitrogen With Phosphorus and Arsenic"]

[FBIS Translated Text] Frankfurt—German scientists have apparently succeeded in markedly reducing the side effects of two tumor treatment substances by substituting individual atoms in them. Researchers at the Asta Medica AG [Inc.] company in Frankfurt have substituted a nitrogen atom in each of the active substances Miltfosin and Edelfosin 2-N with the chemically similar but heavy elements phosphorus and arsenic respectively.

It is a matter of phospholipids in both substances. These molecules consist of a fat-soluble tail of a hydrocarbon and of a water-soluble component that has a positively charged ion of the fifth main group of the periodic system, i.e., either nitrogen, phosphorus or arsenic. The two parts of the molecule are linked by a phosphate group. In the human body these molecules take part in the structure of cell membranes.

The journal ANGEWANDTE CHEMIE [APPLIED CHEMISTRY] (Vol 107, No 2, 1995, p 195) reports that, after synthesis of the element-homologous compounds, experiments have shown that the phosphorus or arsenic drugs are less toxic without however at the same time being less active with respect to tumor cells.

The scientists attribute the interesting effects of the homologous compounds to the fact that phosphorus and arsenic have longer atomic radii than nitrogen does. Therefore these molecules can no longer be mistaken for physiologically active molecules in the body. The mechanism whereby these molecules combat cancer is not yet known.

Germany: Ciba-Geigy Ltd Introduces Closed Plant Protection System

95WS0270C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German No 56, 20 Mar 95 p 10

[Article by rex., Frankfurt correspondent: "Dealing With Plant Protection"]

[FBIS Translated Text] So as to minimize the risks of plant protection, the Ciba-Geigy enterprise has developed the Link Pak closed plant protection system. Safety adapters on the containers take care that the chemical remains confined between its production site and its diluted discharge from the field spray nozzle. Decanting, batching, and cleaning operations take place within the closed system. The plant preservative is poured through a hose from a 200-liter barrel into a 10-liter reusable canister. The latter canister moves back and forth between the barrel with preservative in the yard and field spray nozzle on the farm. For batching the preservative, special adapters are attached to the barrel, to the canister, and to the field spray nozzle so as to ensure that the farmer does not come in contact with the chemical. Also large casks for transporting the plant preservatives are designed to be reusable, as reported by Ciba-Geigy Ltd (51-53 Liebig St. 60323 Frankfurt). After having been emptied, the casks are shipped to a barrel reconditioning shop to be cleaned and prepared for further use. At the present such handling of plant protection benefits mainly large-scale operators. It does not pay small rural operators to purchase 200-liter barrels. One must consider, however, whether in the near future also smaller reusable containers should become available. It is furthermore reported that Ciba-Geigy Ltd may also offer its new system to chemical enterprises as an answer to certain industrial problems.

UK Proposes Easing of Biotechnology Regulations

BR2803145995 Paris EUROPEAN BIOTECHNOLOGY NEWSLETTER in English 21 Mar 95 p 5

[Unattributed article: "GMOs and GMMs"]

[FBIS Transcribed Text] The regulation governing the contained use of genetically modified organisms or micro-organisms will be eased.

The UK Health and Safety Executive committee is suggesting to amend the Genetically Modified Organisms Regulation dated 1992 to implement the new European Directive 94/51 which revises the EU directive on contained use of genetically modified organisms (GMO). The modification includes a simplified system for classifying GMO according to their potential risk to humans or to the environment. The new rules also clarify that waste material containing low-risk genetically modified micro-organisms are covered by the regulations. The new proposal also helps to determine whether the Health and Safety Executive should be notified about the work carried out or planned and whether or not prior approval is required.

The existing regulation remains unmodified with regard to risk assessment, control measures to protect health and the environment, and disclosure of information to the public. Comments on the new proposed regulation and guidelines are expected by March 24.

Western European Union Debates Satellite Reconnaissance Issues

BR2703145195 Paris LIBERATION in French 27 Mar 95 p 22

[Article by special correspondent Jean Guisnel: "Space, the New Armament Frontier"]

[FBIS Translated Text] San Agustin, Gran Canaria—Espionage, telecommunications, early warning, meteorology... Space has become the new frontier for armament manufacturers. At the conference called "For a European Space Observation System," held over the weekend in San Agustin (Canary Islands) under the aegis of the Western European Union (WEU), several dozens of manufacturers and politicians examined the new space systems and, above all, they looked for ways to fund research.

Space program budgets remain high and are not facing cuts as drastic as in other fields. In the United States, the Pentagon still allocates $14 billion a year to space systems (all kinds), and the fact that France and Germany may soon invest over 25 billion French francs [Fr] in two new development programs for military earth observation satellites has not been lost on manufacturers. As things stand, Europe has little to show with respect to military space applications but the Helios I observation satellite, to be placed into orbit this summer by the 75th Ariane rocket (V75), a program initiated exclusively by France, later joined by Spain and Italy (with 7 and 14 percent interests, respectively).

Images from this spy satellite—which will be able to see details one meter in size, in daytime and fair weather conditions—will not just be received by the three partner countries' intelligence services, but also by the WEU, thanks to its photographic analysis station at the Torrejone air base (Spain). Helios II, Helios I's successor, will be placed in orbit early in the next century. It will boast infrared detection capabilities and will most likely be built as part of a French-German partnership. Talks to that effect are currently being finalized between the two countries. The Germans will probably wait until after the French presidential election before they announce their decision.

In the current scheme, which the Germans are not entirely happy with, the French would have the German take a 15-percent participation in the program, which is worth over Fr10 billion, for a 10-percent industrial return. But there is more. As a prerequisite to Germany's participation to Helios II, The French also want it to join another program pertaining to the Osiris radar satellite, which would be able to see details two to three meters in width in any weather as well as nightly—with a price tag comprised between Fr10 and 13 billion. In exchange, and provided they took a 60-percent interest, the Germans would be given control over the Osiris program.

A third set of negotiations is currently being conducted; it regards the merger—which has yet to take place—of the space-related activities of DASA [Daimler-Benz Aerospace] and Aerospatiale. As DASA's head of space activities, Wolf Peter Denker, puts it, all these issues "represent a major debate, highly political," which is characterized in Germany by a total break from the context that prevailed prior to unification. At the time, as part of NATO-defined missions, Germany only had to monitor what was going on along its Eastern borders. Due to its new status, it can now claim the right to have its own autonomous "strategic" intelligence gathering capability, which it has been sorely missing, including when it sent troops to Somalia. Of course, its traditional partner, the United States, cannot fail to be slightly annoyed by Germany's determination. Rumor even has it that the Bonn government was approached by U.S. space equipment manufacturers, including Lockheed, which hoped to sell Germany a complete system with specifications similar to those of Helios II.

To answer misgivings regarding a possible "key" which would let Washington interfere with the pictures, the Americans allegedly told the Germans they could buy both the satellite and the "ground segments" for total control. And a rather overbearing Pentagon delegation went to San Agustin to scold the Europeans about their refusal to cooperate in the field of spy satellites. This means that the Pentagon, despite its huge budget, has been looking for partners to fund its future projects. And Colonel Scott Willey, the head of the Pentagon's international projects, called out: "What does European independence mean? Do you want industrial or operational independence? Why can we not develop jointly a transatlantic system whose data would be permanently available for all partners?" And he added that the old continent would be ill advised to "waste resources." Then the president of the WEU's parliamentary defense commission, the French MP Jacques Baumel (a Balladur supporter), intervened to state that "Europe's future is primarily its members' concern. It needs to straighten out its own business. How could one conceive of a European system that does not include Germany?"

Manufacturers are ready to do everything and did not fail to present military systems they deem crucial but which the Europeans—and especially France, the main financial contributor—have already given up. While espionage is to remain an autonomous capability, everything else will be shared in the future. This is at least what the French head of the missile and space equipment department at the General Delegation for Weapons (DGA), Jean-Pierre Rabault, had to say; after telling the WEU it could take part in the Helios II and Osiris French-German programs if it so chose, he suggested that conversations may already be under way on both sides of the Atlantic concerning future military communications systems meant to replace—around the turn of the century—the U.S. DSCS III, British Skynet IV, and French Syracuse II systems.

Other possibilities are emerging in the fields of meteorology and, above all, early warning systems for

incoming ballistic missile. The Pentagon plans to spend some $12 billion on this program alone, which will supersede the current DSP (Defense Support Programs), and neither France nor Europe appear likely to go it alone in this field.

France: ONERA-MATRA Development Missile Flight Tested

BR2903075495 Paris FRENCH AEROSPACE INDUSTRY NEWSLETTER in English Feb 95 p4

[Unattributed article: "First Flight for ONERA-Matra Development Missile"]

[FBIS Transcribed Text] A new ramrocket-powered development missile was recently flight tested for the first time at the Centre d'Essais des Landes [Center for Open Field Trials] on France's south-west coast. The propulsion system was designed by ONERA [National Office for Aerospace Research and Studies].

The test flight was designed to simulate an interception mission (medium-range ground-to-air missile) followed by an strike mission (air-to-ground) missile complete with evasive manoeuvres.

With the support of the Missiles and Space Directorate, the operation was undertaken under the joint prime contractorship of ONERA, designer and developer of the innovative propulsion system, and French missile manufacturer MATRA, which sees promising applications. Other companies participating in the project include SNPE [National Powders and Explosives Company], CELERG and Aerospatiale.

A ramrocket, also known as a ducted rocket, is an air-breathing, solid-propellant motor. This means that it is as easy to store and maintain as munitions or conventional rockets.

The ONERA ramrocket, known as "Rustique," combines fuel efficiency (three times better than conventional rocket motors) and extreme simplicity. A second test flight is scheduled to take place later this year.

The characteristics of the ONERA ramrocket are in line with specifications being developed for future air-to-air interception and anti-radar missiles.

France: ONERA, Matra Test Ramjet Missile Engine

BR1104140395 Bonn WEHRTECHNIK in German Apr 95 p 50

[Unattributed report: "Ramjet Missile Engine Tested"]

[FBIS Translated Text] ONERA [National Office for Aerospace Studies and Research] and Matra Defense have tested a solid-propellant ramjet missile engine. CELERG will be responsible for the production of the main components of the propulsion system. The order was placed by the DGA/DME [Armed Forces Equipment Authority/Missiles and Aerospace Directorate]. The propulsion system has the following characteristics:

- The missile engine has no separate jet because it is included directly in the propellant block;
- One single ignition command activates a sequence of commands: accelerator, transition, flight;
- The solid-propellant ramjet engine adjusts its altitude without the use of a control system.

A similar propulsion system had been proposed by MBB [Messerschmitt-Boelkow-Blohm] for the ANS [supersonic antiship missile] naval missile but was unable to compete with Aerospatiale.

German Experimental Solar/Hydrogen Energy Project Reviewed

95WS0256B Duesseldorf VDI-Z in German 10 Mar 95 p 23

[Article by Hans Dieter Sauer: "Solar/Hydrogen in the Far Future"]

[FBIS Translated Text] *Neunburg—A system combining solar power and hydrogen is technically feasible, but due to the high costs it is only an option for a more distant energy future. This is the result at which Solar-Wasserstoff-Bayern GmbH (SWB) arrives after eight years of operating its demonstration plant in Neunburg vorm Wald.*

The idea took shape west of the little city of Neunburg vorm Wald in Upper Palatinate. In a clearing between forested hills there are large racks of solar cells placed close together in rows, flanked by gas tanks, a factory building and a gas station. From the solar field the power flows either into the public power grid or it separates water into oxygen and hydrogen in electrolyzer units. After interim storage in pressurized tanks, the gas is used for various applications: power production in fuel cells, heating in thermal output boilers, air conditioning in an absorption cooling facility or as fuel for cars.

From a technical point of view the project has achieved its essential objective. "Although today the partial systems can only be obtained as prototypes, the components could be coupled together into a functioning general system," the managing director of SWB, Manfred Fuchs, recently reported in a press conference at the site. Fuchs stressed that the evaluation of the experience gained in operating the facility has led to constructive improvements in a number of pieces of equipment. Part of this work was in vain, however. For example, the manufacturers of the two new types of electrolyzer units, which based on a different cell design achieve efficiencies of 80 percent, has had to give up the development because of the lack of a market. SWB now wants to use a new potash-lye-electrolyzer with 100 kW power, which works at a temperature of 150°C and a pressure of 32 bar. With that it is possible to store the gas without further compression.

For the fuel cells SWB tested all the techniques available on the world market. A phosphoric acid fuel cell from Fuji Electric with 80 kW electric output, which simultaneously delivers heat (working temperature 190°C) and power, could compete with block-heating power plants in the future. It is an advantage that it works not only with pure hydrogen and oxygen from the electrolysis but also tolerates impure hydrogen from the reforming of natural gas and air as combustion gas. Of the type that is normally only produced by one U.S. company, there are, according to SWB, 100 to 200 units in use worldwide. The unit at Neunburg vorm Wald is, as far as SWB knows, the only functioning facility in Europe.

But people at SWB are already thinking of the next generation of models which work on the basis of ceramic materials at about 900°C. In a few years Siemens will perhaps set up a prototype at SWB.

The use of hydrogen as fuel for cars appears attractive. Hydrogen vehicles would only release water vapor and thus help ease the pollution burden in densely populated areas. Filling cars with liquid hydrogen, however, is anything but simple. Originally, the process of filling the cold liquid took more than an hour, and in so doing 30 percent of the hydrogen was lost through evaporation. Meanwhile, more acceptable conditions could be achieved through the development of a new tank coupling. Filling up now takes less than 10 minutes and losses through evaporation have been reduced to below five percent.

Despite all the technical progress, however, one has scarcely gotten any closer to a solar hydrogen economy. "We still do not have the goal line, meaning market introduction, anywhere in sight," explained Manfred Klis, a member of the board of Bayernwerk AG and chairman of the supervisory board of SWB.

The reason is obvious. At about 2 German marks [DM] per kWh, solar power is much too expensive. Conversion and storage losses further drive up the costs of solar hydrogen, so that the equivalent of 1 liter of gasoline would cost a dizzying DM30. Accordingly, a solar hydrogen economy is an illusion, as long as solar power does not become distinctly less expensive.

In searching for cost reductions, no field may be left out of consideration. SWB is turning a great deal of attention toward making the cost of solar modules cheaper. Thus, it was possible to reduce the weight of the racks per square meter of module surface from 40 kg to below 30 kg. "With a cable-braced mounting rack developed on behalf of SWB the material cost is even as low as 15 to 20 kg/m^2," emphasized Axel Szyska, SWB's managing director for the technology division. But only longer operation will show whether the oscillation behavior of this design is without problems. All in all, however, at the Neunburg large-scale facility, which delivers 20 percent more power output than the small units in the "1000-roof program," it has not been possible to push the cost of generating power below DM2/kWh.

The solar field, which with a module surface of 4,200 m^2 and 370 kW (peak output) is the second largest photovoltaic facility in Germany after Pellworm (600 kW), shows the entire product range of the German photovoltaic industry of the last five years. World market leader Siemens Solar GmbH (SSD), which manufactures almost exclusively in Camarillo in California, and Angewandte Solarenergie GmbH (ASE, created in 1994 by combining the solar activities of Dasa and Nukem), present eight different modules with mono-, polycrystalline and amorphous silicon cells.

In the last few years it has been possible to further increase the efficiency of monocrystalline cells. While in

1990 the peak value was still 14 percent, modules by Siemens and ASE now achieve values around 16 percent (relating to the cell surface). Amorphous cells, on the other hand, do not get above 6 percent. SSG has now stopped the production of this type of cell, for which years ago there was great hope.

In the summer of 1989, a few days after the end of the reprocessing facility at Wackersdorf had been decided upon, Siemens announced that by the mid-1990s it would build the largest factory in the world for amorphous thin-film cells with a capacity of 20 MW on the WAA site. It was thought that the modules would be installed in window panes and car roofs. At the time, Siemens's advertising department provided the accompanying music for this: "Window panes as small power plants will certainly arrive in the next decade." These high-flying plans have now disappeared into thin air.

Regardless of the cost, solar hydrogen will only become a major player if so much solar power can be produced that it can no longer be sold right away. According to a rough estimate by Bayernwerk, beginning with a photovoltaic output of 25,000 MW one could expect that on beautiful summer days, even when all conventional power plants are shut down, a surplus of power would be produced in the German power grid. The power volume installed in Germany is still below 10 MW, and world annual production has reached 60 MW. These ratios show that the solar hydrogen economy is still far away. In agreement Klis quoted a statement from the report of the Technology Assessment inquiry commission in 1990: "An extensive introduction of the solar/hydrogen economy cannot be expected before the year 2025."

DM64 million were spent on constructing the Neunburg project from 1987 to 1991, and for the current project phase another DM81 million are planned up to and including 1999. Half of the cost is assumed by the participating companies in accordance with their shares, 35 percent is funded by the Federal Ministry for Education, Science and Research (BMBF), and the remaining 15 percent is contributed by the Bavarian Ministry for Economics and Communication.

It will hardly be possible to continue to operate the Neunburger project in its present form for another three decades as an expensive "test field and place-holder for future technologies." SWB's shareholders want to find out by 1999 about its continued progress. "What is going to happen in the next millennium is an open question," noted Klis regarding this. But Bayernwerk will in any event continue its involvement in the field of renewable energies.

[Photo caption, photo not included]

A consortium of companies is testing the solar/hydrogen technology in Neunburg in Upper Palatinate. An electrolyzing facility produces up to 22 m^3 hydrogen and 11 m^3 oxygen each hour (at normal pressure) from pure water. The energy is supplied by about 8,300 solar modules, which in good weather deliver about 370 kW electric power.

France: Advances in High Speed Machining Technologies Reported

General Overview

95WS0265A Paris L'USINE NOUVELLE in French 16 Feb 95 pp 46-48

[Article by Daniel Chabbert: "Tooling Fabrication: Spectacular Results"]

[FBIS Translated Text] **After a slow start in light alloys, high speed milling is now in overdrive: it is no longer intimidated by such hard materials as manufacturing steels. It could revolutionize tooling fabrication.**

We had to wait for some 15 years for very high speed machining (UTGV) to reach its full maturity for milling. After a slow start, applications are beginning to multiply in light alloys. Even more interestingly, hard materials UTGV is becoming an industrial reality. In manufacturing steels, for instance, rotation speeds of 30,000 rpm and advance speeds of 10 m/min are technically and economically feasible. The cutting speeds they enable are from five to ten times higher than conventional speeds, and easily reach 1000 m/min.

These performances thus multiply machine productivity three- and even five-fold. Equipment supporting such cutting conditions is already listed in the catalogs of some machine-tool manufacturers. Our country is in fact a forerunner in this field. As early as 1979, Forest joined Dassault Aviation to validate this cutting technology, before it even left the laboratory. Four years later, the French manufacturer put on the market the first horizontal-spindle UTGV center designed for light alloys. Unfortunately, the various restructuring plans for the French machine-tool industry, which also affected Forest, stymied its technical progress, while the worldwide competition catches up its own delays.

"During the 80's, the first UTGV machines that appeared on the market were primarily dedicated to the machining of simple light alloy parts," explains Marcel Palleau, in charge of machining services at Cetim (Technology Center for the Mechanical Industries), "but by the same token, their operating advance speeds were already reaching 10 m/min."

Despite its encouraging performance, UTGV did not encounter the success the specialists expected, and for two reasons: one technologic and the other commercial. At the time, the technology of some of the machine's components, notably the spindles and the numeric control, limited its performance, especially in the milling of more complex shapes. The crisis in the aeronautic sector (the major customer), which led to surplus capacity in production facilities, also withdrew much of the economic interest in UTGV.

At about the same time, machine builders entered the field of high speed machining of cast iron and steel. But the first attempts to transfer laboratory results to industrial applications rapidly revealed a lack of reliability.

It was not until the beginning of the 90's and certain major technologic advances—such as the development of electrospindles with ceramic ball bearings, and the evolution of numeric control with high computing power—that the UTGV market in a position to start anew.

Given the magnitude of the economic stakes involved in the machining of tooling (molds, dies, and so on), this is the application that derives the greatest benefit from these latest advances. Caught between the competition of cheap manpower from such countries as Portugal and South Korea, and the purchasing agents of the automobile industry who are constantly lowering their purchase prices (an average of -5 percent per year), the profession is forced into enormous productivity increases.

"If we take the example of a car bumper," says Patrick James, from GE Plastics, "the investment for a mold for a single fabrication will cost about two to three million francs [Fr], which is allocated to the investment needed for the associated facilities (injection press, robot, cooler). This is equipment that can be reused later." These figures illustrate the great importance of the mold, both in terms of initial investment and frozen funds, and of the costs of poor quality in case of problems. Moreover, the trend in the auto industry is to multiply new models, and in return, to reduce the size of manufacturing runs. Thus, as James points out, "in this calculation, the impact of tooling cost on a run of one million parts is of the order of 5 percent, whereas for a run of 100,000 parts, the tooling cost impact climbs to 50 percent of the cost of the part." Philippe Bagard, engineer in Cetim's mechanical production department, adds: "In 1993, the tolerance of cold-forged parts went from 0.05 mm to 0.02 mm at Peugeot. It is thus fully reflected in tooling quality." As another example, the surface finish required for door dies is henceforth less than 0.5 micron Ra, and could drop to 0.01 micron Ra.

Tooling manufacturers must therefore decrease fabrication costs and deliveries, while increasing the quality of their production. UTGV is one way to win in all respects. "Out of 100 hours of machining a mold to cast an automobile plastic part, 20 hours are taken by designing the shape, forty hours for semi-finishing, and equally as many for finishing," explains Bagard. Added to these machine times is the manual polishing time, which falls between 50 and 70 hours."

It is exactly in these semi-finishing and finishing operations that the highest productivity losses reside. By increasing cutting speed (advance and rotation speed) during finish milling operations, it becomes economically possible to work with a reduced cutting width (difference between the tool's advance and return path), which creates lesser ridges on the machined surface. This reduces, and even eliminates, the time required for subsequent manual polishing operations.

A full-size test conducted by Forest Line for Peugeot Citroen Industrie (PCI) on a punch for a 405 trunk panel lining, is an illuminating example. The finishing of the tooling with UTGV (16,000 rpm rotation speed, 8 m/min advance speed) did not exceed 40 hours, compared to 120 hours with conventional machining. In addition, the time required for smoothing and stoning to complete the part was divided by five. As a result, the total cycle time required to fabricate the part went from 460 to 160 hours.

However, an investment in UTGV is not enough to produce such spectacular results, because UTGV initially requires a complete reconsideration of the conventional rules of machining. To begin with, machining conditions ha e to be redimensioned. "They must be totally revised," points out Alain Auffret, technical director of Precise France. Two major parameters differentiate UTGV from conventional cutting methods: advance speeds are much higher (at least equal to 2.5 m/min), while the depth of cut remains small (only of the order of a millimeter). Indeed, the productivity of UTGV machines is based on high speed surface sweeps, even if they are presently still unable to machine into hard materials.

Not to be overlooked is a review of the tooling shop. Traditional tools may actually not be sufficiently strong to withstand high cutting speeds; tool attachment, lubrication devices, and even CAD/CAM [Computer-Aided Design/Computer-Aided Manufacturing] systems will have be readapted.

The complete economic balance sheet of UTGV will thus also have to include these additional costs, as it must take into consideration the training of setup and operation personnel. Personnel involvement is indispensable if this high performance but very demanding technology is to be used to best advantage.

[Box, p 46]

High Speed or Very High Speed Machining?

For Jean-Claude Crappart, head of the mechanical department at Cetim, "there is no significant difference between high and very high speed machining. From the standpoint of the cutting process, the two names imply a large increase in cutting speed, which in turn changes the chip formation process." The values of rotation and advance speeds depend on the machining operations involved and on the materials being machined. In very high speed (or high speed!) milling, for instance, cutting speed can exceed 1000 m/min in light alloys, but 100 m/min in titanium alloys.

Specific Industry Development Presentation

95WS0265B Paris L'USINE NOUVELLE in French 16 Feb 95 pp 48-50

[Article by D. C.: "France's Contribution to Advanced Technology"]

[FBIS Translated Text] **The future of French machine building is in high gear. A daring technologic and commercial wager, which holds great promise for this industry, beleaguered for the past 15 years.**

The French machine-tool industry is often painted as moribund. After the repeated restructurings it has undergone for a good 15 years, it was said to be incapable to innovate. Yet, if there is one area in which this profession is now ahead of its foreign competition, it certainly is in high speed machining. "German and American manufacturers are not more advanced than ours in this field," says Crappart. "The Japanese manufacturers which were well ahead at the end of the 80's, especially in the machining of aluminum parts, don't appear to have progressed since then."

This machining process whetted the curiosity of French manufacturers very early in the game. Forest Line, for instance, was one of the European pioneers in UTGV milling. Its first studies on light alloy parts for the aeronautic industry, jointly carried out with Dassault, date back to more than 15 years ago! In 1985, the French manufacturer even began very high speed milling of hard metals, sponsored by the Ministry of Research and in collaboration with Renault and PSA. After several lean years, due largely to blocked investments in aeronautics, business picked up vigorously for Forest Line in high speed machining. "In 1994, we conducted four tests on real parts for various customers," points out Pierre Tillement, director of the aeronautics department at Forest Line, "not counting our current collaborations with two large aircraft builders." The Capdenac manufacturer has also sold (very confidential!) several hard material milling machines for molds, dies, and models.

At Realmeca, the first tests on aluminum alloys began in 1987, first for its internal needs (this manufacturer is also a precision machining subcontractor), and several years later to develop a line of machines specifically for high speeds. Today, the latter represents 3 percent of the total machines sold.

For Huron Graffenstaden, the transition to high speed came later, but more radically. "We brought out our first prototype at the Hanover EMO in 1993," indicates Guy Bitterolf, technical director of Huron Graffenstaden, "and today we are already deriving nearly 40 percent of

our revenue with this type of machines." Thanks to the introduction of a smaller capacity model, Huron Graffenstaden even expects to exceed 50 percent in the coming years.

To reach this stage, significant expenses have been allocated by the French builders. CMS, the last manufacturer to enter this field—it has just completed its first prototype—will have spent nearly Fr4 million to carry out its project, which is a very heavy budget to support for a PMI (small and medium-sized industry) with an income of Fr100 million. The financial effort was similar for Huron Graffenstaden, which spent Fr8 million from revenues of 170 million in 1994. For Forest Line, the sums were even huger, matching the size of the large capacity machines it manufactures: more than Fr10 million for the development of high speed in aluminum, and at least as much for milling machines designed for hard metals.

A Great Mobilization

Encouraged by this experience (and the significant expenses already undertaken), the French manufacturers do not of course want to stop there. But will they have the strong backs needed to fight against the foreign competition which is sure to make itself known before long?

In any case, they will not be the only ones to work on this subject in the country. All the French actors with any interest in machining—large users (aeronautics, automobile, weapons, and so on), university laboratories and some technical centers (beginning with Cetim)—have been mobilizing for two to three years. They have finally understood the benefit of some coordination of research in France, faced with the strategic importance of this new technology for French industry. That is how the Very High Speed Machining Association was created as a first step; in 1990, its debates led to a joint research project, "Technologic Expansion in Hard Material Milling and Drilling" supported by the Ministry of Research.

The first results of this program, which will be made public in mid-1995, should be of significant help to the French manufacturers; it will be beneficial both technically and commercially. While technology is reaching maturity, human mentality evolves more slowly, and UTGV has unsettled the conventional rules of machining. And the research projects supported by the Ministry of Research can only reassure the French industry, which is not always very ready to take such a giant technologic step (and make such an investment).

[Box, p 47]

Technology Monitoring and Exchange in AUTGV

Created in 1990, the Very High Speed Machining Association (AUTGV) is meant to facilitate technology monitoring and exchange. It is composed of about 20 partners working with UTGV or with activities in this field. Some of these are the laboratories of large industrial groups (Renault, PSA, SNECMA, Aerospatiale, and so on), machine builders (Forest Line, Realmeca), spindle suppliers (Precise, S2M), user enterprises (Sagem, Leroy Somer, Cnim, and so on), universities (ECN, Insa, Enset, and so on), and of course, the Technology Center for the Mechanical Industries (Cetim). The association is currently at the start of a research project on UTGV milling and drilling of hard materials, initiated in 1991 by the Ministry of Research.

[Box, p 49]

A Strategic Research Project

Convinced of the strategic importance of UTGV to France's mechanical enterprises, at the end of 1991 the Ministry of Research initiated a vast research project called "High Speed Milling and Drilling of Materials with High Specific Cutting Coefficient." Fifty percent of this Fr27 million project is financed by the state, and involves 13 industrial partners, most of them from the AUTGV. The objectives of the research program are to provide users with the new facts essential for benefiting from the technologic and economic advantages offered by this cutting process. The first phase, which will end next June, focuses on the characterization and modeling of the process. A summary publication will then be assured, but the complete results will remain confidential.

Five Manufacturers of UTGV Mills

Manufacturer	Model	Machining Capacity	Advance Speed (m/min)	Number of Axes	Spindle Orientation	Power Spindle (kW)	Spindle Rotation Speed (rpm)	Spindle Vector Control	Fields of Application
CMS	Arthemis UGV	400 per cube to 1000 per cube	5	5	Vertical	11 to 30	25,000 to 30,000	Yes	Molds Graphite electrodes Models Aeronautics
Forest Line	Minumac (with high rail or mobile gantry	X=4000 mm to 10,000 mm; Y=1700 mm to 3200 mm; Z=1250 mm to 1500 mm	Up to 15	5(+1)	Vertical and inclinable	12 to 24	6000 to 40,000	Yes	Molds Models Tooling Routing of composite materials
	H1 1600	X=1500 to 4000 mm; Y=1000 to 1600 mm; Z=800 mm	20	3	Horizontal	15 to 40	30,000 to 40,000	Yes	Aluminum wing panels for aircraft
Henri Line	Gicamill 19	1500 mm x 1500 mm; X=up to 10,000 mm	6	5	Vertical	25,18,24,40	24,000, 10,000, 16,000, 4000	Yes	Models Plastic molds Electrodes Dies Punches
	Gicamill 24	2000 mm x 2000 mm; X=up to 10,000 mm	6	5	Vertical	25,18,24,40	24,000, 10,000, 16,000, 4,000	Yes	Models Plastic molds Electrodes Dies Punches
Huron Graffenstaden	EX	X=1200 mm to 1400 mm; Y=700 mm; Z=600 mm to 800 mm	15	3 to 5	Orientable	25	14,000 to 24,000	Yes	Prototype parts for automobiles Aeronautics Space Molds, models Turbine blades
Realmeca	C200	200 mm per cube	10	3 to 5	Vertical	11	30,000 to 45,000	Yes	Precision machining, Plastics technology, Models, Optics, Medical equipment
	H200	200 mm per cube	10	3 to 5	Horizontal	11	30,000 to 45,000	Yes	
	C300	300 mm per cube	10	3 to 5	Vertical	15	30,000 to 45,000	Yes	
	H300	300 mm per cube	10	3 to 5	Horizontal	15	30,000 to 45,000	Yes	
	C400	400 mm per cube	10	3 to 5	Vertical	18	30,000 to 45,000	Yes	
	H400	400 mm per cube	10	3 to 5	Horizontal	18	30,000 to 45,000	Yes	

Technology Analysis

95WS0265C Paris L'USINE NOUVELLE in French 16 Feb 95 pp 50-51

[Article by D. C.: "Very High Speed Machining: A High Technology Digest"]

[FBIS Translated Text] **High speed cannot be improvised. The first machines dedicated to this cutting process are very sophisticated. A look inside a typical milling machine.**

To benefit from all the advantages of high speed machining, particularly in terms of productivity, you cannot skimp on the means. The price of a very high speed milling machine is a good example: depending on size and configuration, the first models offered by the manufacturers cost from one and one-half to two times as much as a conventional one, because they must be equipped with a range of devices specially adapted to high advance and cutting speeds.

The Structure

A mill intended for hard materials for instance, must first of all have a redimensioned structure. "This type of machine must be specially designed to readily respond to successive rapid orders," explains Francois Lhullier, technical director at Realmeca. The mechanical structure will be extremely rigid, massive, and at the same time light. The slides will be mounted on pretensioned bearings to avoid play and enable high precision micromotions. Operator protection will also be enhanced, notably to protect against tool breakage during operation. "The machine enclosures must be able to stop tool pieces flying out at nearly 100 m/s," points out Bitterolf.

The Spindle

A very high speed mill will also have a spindle that is precise, rigid, rapid, and powerful (around 25 kW at rotation speeds of 30,000 to 50,000 rpm). Currently, electrospindles mounted on hybrid bearings (ceramic balls) appear to be the best cost/performance compromise, compared to spindles running on magnetic bearings, for instance. Today, their life readily exceeds 10,000 hours of full speed operation.

Spindles with vectorial servo control will also be necessary to carry out milling operations in hard materials. In fact, this electronic device makes it possible to obtain very high torque at a very low rotation speed rather than at a minimum of 3000 rpm as in the case of previous models.

The Tools

"It would be a serious error to consider reusing conventional tool holders," indicates Lhullier. New ones will have to meet ISO [International Standards Organization] or HSK standards, be capable of cone/face mounting, be dynamically balanced, have no drive tenon, and have high quality jaws.

The task is more delicate for the tools themselves, because the choice will be determined by the type of operation to be performed and the materials to be machined. According to Bagard, high speed steel tools, even if clad, can be eliminated from the start. "Their resistance to high speeds is not sufficient. What is more, their relatively low Young modulus encourages flexion and vibration, and thus affects precision and surface condition," he points out.

For softer metals, monobloc carbide tools will be preferable. In turn, CBN (cubic boron nitride) tools will be particularly competitive for machining very hard materials. Depending on the hardness of the material—hardness which today can reach into 60 HRc—cutting speeds of 150 to 1000 m/min are conceivable.

Tool design is also a primordial parameter in the search for very good surface condition and correct cutting precision. That is why a reinforced long tool will be preferable to a short non-reinforced one. During its tests, Cetim has also observed that the flutes affect the rigidity and vibration behavior of the tool. By the same token, the presence of a helical angle is favorable because it reduces discontinuity in the cut.

However, few tools are yet sufficiently well adapted to UTGV. According to Bagard, "only 20 percent of the tools currently available on the market give good results."

Tool lubrication will also have to be adapted to this technology. The conventional spraying of cutting fluid does not in fact lubricate edges: a spinning air shield around the tool prevents contact with the fluid. A system of pulsating drops of lubrication fluid in a projected air flow will thus prove to be preferable.

The Numeric Control

If the mechanical construction of machines must be designed specifically for UTGV, the same is true for the control electronics. According to Forest Line, in order to follow profiles with sufficient precision, the numeric control must be based on a 32-bit architecture, very fast block processing (less than 10 milliseconds), parabolic management of acceleration/deceleration rates, and a computing algorithm for processing speeds in advance. "On a conventional machine, 10 vision blocks are enough to anticipate changes in the path," explains Eric Szmata, marketing and product director at Num. "A high speed mill needs three times as many."

The French manufacturer also foresees digital motors for all the machine axes (digital variable speed drives) in order to improve motion precision at high speeds.

[Box, p 50]

Can A Conventional Machine be Adapted to UTGV?

For only 200,000 francs, various rebuilders offer to transform a conventional milling machine into a true

UTGV machine. All you need to do is replace the spindle motor with an electrospindle, the original numeric control with a higher performance model, and you're in business. But is it possible to achieve a performance comparable to that of a machine that was specially designed for this technology from the start? It is difficult to answer affirmatively, given the high rigidity and speed characteristics required for the combined mechanical structure and moving parts. However, under some utilization conditions which do not require high machining precision or very high cutting speeds, this type of investment can prove profitable. It may also be a good way to become familiar with UTGV at low cost. But careful about safety problems! The protection indispensable for high speed machining has nothing in common with that used with conventional machines.

Germany: Virtual Reality Systems Expected to Aid Manufacturing

95WS0271B Munich COMPUTERWOCHE in German 3 Mar 95 p 22

[Article: "Virtual Factory Continues to Require Far-Reaching Commitments"; subhead: "Detailed CAD Data Become Bottleneck"]

[FBIS Translated Text] **Munich—The tenor of the Stuttgart Conference, "Virtual Reality World '95," was that the development of virtual reality systems is currently marked more by the technological pioneer spirit than by actual customer demand. The conference's program confirmed this situation: the applications presented for virtual factories and robots still derive overwhelmingly at present from the laboratories of research institutes and manufacturers. A major breakthrough is expected only if industry too relies on the potential of such technology.**

Conservative opinion on the part of authorities and the branches precisely in the area of the architecture aimed at virtual reality (VR) hold experts accountable for the fact that at present they still continue to operate mostly with 2D [two dimensional] designs. Christian Bauer, a branch specialist from Innsbruck, cites the footdragging of mid-size and large industry too as an impediment to VR development in German-speaking areas. Potential groups of customer from the automotive, aviation and space industries did generally express interest in the new technology and would also regularly attend international VR meetings like the one in Stuttgart, but so far only a single group in Daimler-Benz AG [Incorporated] was capable of opting for rather sizable investments. Firms like Volkswagen, Audi, Porsche, Opel and BMW, on the other hand, took a more guarded attitude. Bauer sees a vicious circle here: compared with U.S. behavior where the firms are experimenting even with recent technologies that have not been brought to maturity to develop prototypes and preliminary product versions, in Europe the willingness to take on risk for this purpose is rather slight—a sorry basis for producers to develop VR products to market readiness.

Daimler-Benz, by contrast, boasts of having researched the field of VR even at a time when no one was even familiar yet with the term. Current projects and those put forward at the Stuttgart conference involve the remote manipulation of space robots, new flight and driving simulators as well as technologies for the ergonomic design of the inner space of vehicles. Currently, at Mercedes Benz they are specifically working on the simulation of a robot-controlled installation of vehicle components such as fuel tanks and dashboards.

The comprehensive integration of all CAx [computer-aided-x] development steps for products and their design, in this connection, however, has to be treated ambivalently. The logical subsumption of design data in a simulation becomes a bottleneck because of the plethora of details. For example, to detect potential risks of collision during tank installation, the Stuttgart experts have to spend more than 70 percent of total experiment time on creating an appropriate, definitely simplified geometric model. Programming of the virtual robots and actual simulation accounted for only 28 percent. According to Mercedes-Benz, the data-file source will therefore constitute the biggest problem even for other VR applications. Only if the cost of the modeling can be significantly reduced can any breakthrough in this technology be expected.

The Heinz Nixdorf Institute of the Amalgamated University of Paderborn is also active in virtual factories. Headed up by professor Juergen Gausemeir, the desire there is to simulate a firm with its typical corporate processes of planning, production preparation and order processing. A detailed computer model should enable 3D [three dimensional] realtime visualization.

To keep the situation as realistic as possible, commercially available CAD/CAM [computer-aided design/computer-aided manufacturing] and PPS programs are built in. Later, using head-mounted displays [HMD] the user can access individual production cells and use the programs.

The project is currently in the initial phase, wherein prototypes are realized for separate production stages. The premise of the Paderborn group is that this step imposes the greatest demands on graphics and interaction. A two-stage systems architecture is used in it: one stage entails generation of the scenario, the second, the computation of the technical and physical behavior of the virtual machines.

That modeled data is consistently developed as object-oriented and contains numerous submodels, for example, in the graphics segment for polygons, illumination, animation and textures. The hierarchically structured class model is kept as simple as possible and forms one of the key components for the so-called virtual environment.

The core hardware is an "Onyx/RE2" SGI workstation with four RISC [reduced instruction set computer] processors (R4400, 150 megahertz), 256 MB [megabytes]

RAM [Random Access Memory] and Multi Channel Option (MCO) for graphics output on the two head-mounted displays. While the Onyx machine is primarily reserved for rendering outputs, an Indy workstation assumes all other computations that have nothing to do with image development. The two computers are connected to one another via Ethernet.

The active visitor is fitted with an HMD and a flying 3D mouse. To allow even more passive visitors to participate in the tour, the image signals are sent to a stereoscopic projection wall, paralleling the HMD. The team from Paderborn uses British Division Ltd.'s "DVS" as the basic program in its software, since it offers the advantage of allowing a VR application also to run via a network to distributed computers.

Although the technology for VR applications is available with this or similar systems, it remains in its infancy. This is what the experiences assembled with VR participants at the Department of Manufacturing Engineering and Operations of the University of Nottingham, England, as reported in Stuttgart, boiled down to. At the research institute industry representatives had the opportunity for a one-day tour through a simulated production cell using an injection-molding process to produce plastic doll prams for children.

The entire production process, including transport of the product via forklift to the warehouse, was imaged. The most significant feature mentioned was the participant's interaction with the system: he had the chance to start the machinery, could remove their side panelings to observe the guts of the production process from various viewing angles and also had influence over the product design.

Reactions alleged that such systems are indeed useful but still barely user-friendly and inappropriate for complex modeling tasks given the currently available interface technology. At best, the design functions were only adequate for preliminary designs and were incapable of replacing CAD programs.

Germany: Radiotracer Optimizes Chemical Manufacturing Process

95WS0267A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 17 Mar 95 p 8

[Article by G.M.: "Tracers Helping in Process Optimization. A Material's Path Through the Manufacturing System Can Be Better Studied"]

[FBIS Translated Text] Frankfurt—In collaboration with the chemical industry and its allied industries, the Fraunhofer Society in Munich now wants to use radiotracers for the specific purpose of being able to track "live," in a way, the course of chemical processes. The prerequisites for optimal product-oriented system operation are to be further improved with this.

Radiotracers are short-lived radioactive substances that have been used until now mainly in nuclear medicine diagnosis for monitoring the functioning of organs and metabolic processes. The idea of specifically tracking chemical reactions too by means of radiotracers is really not new here. But the combined use of the tracer technique with the latest methods of computer-controlled applied metrology now promises prospects of success in application to chemical processes.

Encouraging preliminary experiments were performed at the newly founded Fraunhofer Institute for Acoustic Diagnosis and Quality Assurance (EADQ) in Dresden. In so doing it was shown that the possibilities for using tracers in chemistry have been improved decisively by the added capabilities of applied metrology.

According to the research institute, radiotracers halving half-lives of a few minutes to a few hours are suitable for tracing the path of a material through the system. The tracers are easily admitted to the material stream here. They do not differ in their transport properties from the substance of interest, but can be located quite precisely because of their weak radiation.

The knowledge gained through the use of tracers also helps to make designs more in accordance with the product and to optimize the operation of extruders, mills and other chemical technology equipment. Because the area of application within the chemical industry is so large, numerous discussions about potential sharing are under way at present. As the rumor goes, not only large groups are under discussion, but also numerous small and medium-sized companies.

This development is also interesting in the context of integrated environmental protection. In the very recent past the chemical industry has already been able to achieve considerable advances here. Optimized process control has contributed quite decisively to such projects' being crowned with success. The Fraunhofer Society expects that the use of the tracer technique could bring about further advances here.

Netherlands: Dendrimer-Based Catalyst Studied at University of Utrecht

95P60155A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 31 Mar 95 p 8

[Unattributed article: "Catalyst System Based on Dendrimers"; "University of Utrecht Studies Bases of This Technology"

[FBIS Translated Text] In contrast to heterogeneous catalysts, homogeneous catalysts are in a similar phase, for example liquid or solid, and have, among others, the advantage of very fast reaction and higher kinetics, and therefore improve the efficiency of chemical reactions. They are used less frequently in chamistry, since homogeneous catalysts are often very difficult to reseparate, which frequently increases the cost advantage.

An economically interesting solution is possibly soluble dendrimers, which can be recovered from a liquid state with special filters. Their physical properties (molecule size, solubility, dispersion ability) can be adapted and controlled relatively easily in certain catalytic processes.

New homogeneous catalytic systems will be developed at the University of Utrecht (Department of Metal-Mediated Synthesis, Padualaan ?, NL-3584, Utrecht) in order to acquire the basis for application of dendrimers.

One wishes to use them as addition reactions in order to be able to add halogen-containing hydrocarbons to carbon double bonds. These types of bonds are required to construct synthetic, pharmacological materials. Simple synthesis with dendrimers can help to reduce production costs significantly.

Polysilane dendrimers, which easily bind to hydrocarbon-containing nickel complex bonds as catalytically active components, are used. The dendrimers are separated in the case of polysilane complexes on the way to ultrafiltration. They can be so designed after production by the developer that continuous catalytic systems, which consist of an inexpensive and economical system (because) of reuse, can be considered.

Germany: Status, Prospects of Photonics R&D Reported

MI0704065695 Berlin NTZ in German No 3, Mar 95 pp 59-60

[Unattributed report: "Photonics Funding Bears Its First Fruit"; first paragraph is NTZ introduction]

[FBIS Translated Text] Trunk lines have been laid almost exclusively in optical fiber technology since as far back as the mid-eighties. However, the technical potential of photonics far exceeds this area of application; indeed, one of the goals that photonics sets out to achieve is to use advances in optoelectronics and micro-optics to open up a long-term prospect for fully optical system solutions in, for example, message switching technology.

New Information Systems for the Future

Photonics is now acknowledged worldwide to hold out high future potential capable of contributing to technical breakthroughs and bringing about new information systems. The Federal Government has thus been funding research and development projects on the subject under its Information Technology funding scheme since 1990. The projects involve companies, research facilities, and universities.

The first phase in the Photonics funding program (which lasted four years) comprised two joint research projects: one on Optical Signal Processing (OSV) and the other on Optical Link Technology (OVT). Both projects set out to study the potential of photonics for information technology and to demonstrate it in selected experimental systems.

Whereas the OSV consortium focused largely on optical message switching technology, the main task in optical link technology was the integration of optical links into an electronic environment. The original 32 individual projects were joined in the course of 1992 by additional research projects in the new federal laender, the inclusion of which in the work in process contributed to the rapid integration of the universities and newly established research facilities there into the optoelectronics and photonics research scene.

The results of the initial stage, which the BMBF [Federal Ministry of Education, Science, Research, and Technology] funded to the tune of approximately 95 million German marks [DM], have now been announced. Remarkable achievements have been made as regards key photonics components, including surface-emitting laser diodes. Lasers of this type can be produced in a matrix-shaped configuration and are ideal for free-beam optical connections in an extremely confined space. In order to obtain high packing densities, these components must have low power dissipation. The surface-emitting lasers developed by researchers at the University of Ulm lead the international field in this respect and are of particular interest for optical link technology.

Researchers at the Fraunhofer Institute of Applied Solid-State Physics (IAF) in Freiburg worked on laser diodes for optical transmission. The 30-GHz modulation bandwidth demonstrated in these laser diodes exceeds even Japanese and American achievements. This high bandwidth makes it possible to transmit optical signals at a speed of 35 Gbit/s, with the result that, for example, 250 HDTV [high-definition television] quality programs can be broadcast over a single optical fiber at the same time.

The IAF also achieved another world record with an optoelectronic receiver designed as a monolithically integrated circuit (OEIC [optoelectronic integrated circuit]). The gallium arsenide-based circuit, which consists of a photodiode and a two-stage amplifier, is capable of receiving optical signals at transmission rates up to 20 Gbit/s.

New Developments Open Up Broad Fields of Application

It is hoped that the development of these monolithically integrated system components will make it possible to improve device properties, functionality, and reliability and to reduce assembly and, first and foremost, production costs. This is expected to open up broad fields of application for photonics.

A major contribution has been made by the Heinrich Hertz Institute (HHI) in Berlin in the form of a glass fiber cable tuner chip, which has proved that it is technologically feasible to series-manufacture a highly complex monolithically integrated optoelectronic component of this type, the production of which involves 170 individual process steps. This is a milestone along the road to the mass production of key photonic components, such as those required for economic links to the future "fiber-optic data highways."

German Telecommunications Industry's Strong Position

As this and numerous other examples show, the high potential held out by photonics for information technology has been demonstrated and a major springboard has been created to help the German telecommunications industry maintain its strong position. The orientation of the funding scheme has also proved correct from the international point of view, added to which close cooperation has sprung up between universities, research facilities, and industry and is set to continue over the coming four years. The Federal Ministry of Education, Science, Research, and Technology will be funding about 40 photonics projects in this second stage to the tune of approximately DM110 million.

The projects will build on results to date and show a stronger bias toward the promising application prospects emerging in information technology and telecommunications. Focusing the research work on specific target systems will also enhance the interplay between technology and system development, thus creating productive synergies.

Second Phase of Funding Focuses on Specific Target Systems

The second phase of the project will develop information systems for 40-Gbit/s, and subsequently 100-Gbit/s, transmission rates, optical fiber amplifiers for hitherto unattainable wavelength ranges, and optical switching networks for message switching systems. Another major topic is massively parallel optical link systems. The core projects are flanked by projects that set out to develop and provide the requisite technologies, key devices, components, and subsystems.

In the future, photonics will effectively complement electronics in many areas and supersede conventional, purely electrical communications. It will be used everywhere where electrical processes come up against the limits of their technical and physical capacity or are more expensive.

German Research, Developments in Optoelectronics Viewed

95WS0291A Duesseldorf HANDELSBLATT in German 1 Mar 95 p B10

[Article by Achim Scharf under the rubric "Optoelectronics": "Light Transmits Data. Fast and Compressed"; first paragraph is an introduction]

[FBIS Translated Text] **Optoelectronics can lead to technical breakthroughs and to completely new information systems. BMFT [Federal Ministry for Research and Technology] is supporting to 1998 the photonics program, whose first results were presented recently.**

Tuesday, 28 Feb 95 (HANDELSBLATT)—Broadband information transmission, under which heading also come trunked telephone and data transmission channels, in long-distance traffic is founded predominantly on fiberoptic circuits. Now typical of optical fibers or optical waveguides is the fact that information digitally modeled as light pulses is transmitted via laser diodes (electrooptical transducers) and is reconverted into electrical signals by photodiodes at the receiving end. Because optical fibers have been quite fully developed technically by now, the development of powerful broadband networks that are also profitable depends especially on innovations in optoelectronic components.

But optical signal processing and optical communication technology could initiate quantum leaps in computer technology too, because of more efficient signal processing. The Federal Ministry for Research and Technology (BMFT) for this reason supported the development of optoelectronic components under the title "Photonics" with around 95 million German marks [DM] in a first phase from 1990 to 1994.

Thirty-Five-Gigabit-per-Second Laser Diodes

Close cooperation has developed between universities, contract research institutes and industry because of this program, and this cooperation will continue in the next four years too with DM100 million in support money.

What a large role optoelectronics is playing for information technology was demonstrated after the recently presented results of the first phase. It is maintaining the competitiveness of the domestic telecommunications industry.

For instance, laser diodes with a bit transfer rate of 35 gigabits per second were developed at the Fraunhofer Institute for Applied Solid-State Physics (IAF) in Freiburg. Just under 250 high-definition TV (HDTV) signals could be transmitted simultaneously by these over a fiberoptic line. A gallium-arsenide-based photodiode developed also at this institute takes it to 20 gigabits per second.

According to BMFT, these results outstrip equivalent research in the U.S. and Japan. A fiber optic cable tuner chip developed by the Heinrich Hertz Institute in Berlin also falls into this category. Although it was possible to demonstrate that the mass production of such a monolithic integrated optoelectronic chip (170 process steps) is technologically masterable, nevertheless it is still uncertain whether German manufacturers are able to produce on a large scale and at reasonable prices such new merchandise for the future "fiber optic information superhighway."

Erlangen University together with Siemens studied optical interconnections by means of light-conducting plates and microoptical components for switching centers in telecommunications. Here a polished glass plate functions as the "backplane," i.e., as a substitute for conventional electrical connections. Optical in- and out-coupling were implemented by means of holographic coupling elements. Packing densities of up to 1000 channels per square centimeter were implemented for transmission distances of between a centimeter and a meter, and it was thereby also shown that free-space optical communication from user terminals permits substantially greater parallelism than electrical communication does.

Up to 1000 Channels per Square Meter

Daimler Benz AG [Inc.] developed a new kind of design for optical interconnections between several chips or chips and printed-circuit cards. Researchers placed optical glass elements having a 1- to 4-multimode-waveguide distribution structure closely over the electrical plane. These optoelectronic transducers transmit and receive light perpendicular to the substrate plane via micromirrors in the waveguides of the glass plate. The clock and data distribution in four chips with a bit transfer rate of one gigabit per second was demonstrated. Optical interconnections between several printed-circuit cards were tested with planar polymer waveguides on a backplane.

In this connection, Alcatel-SEL demonstrated a single-mode optical communication system for short distances in flexible polymer optical fiber ribbons. Siemens and

IAF offered optoelectronic components having tailored optical, electrical and mechanical parameters. The positioning of the components with permissible deviation of one-micrometer is in accord with dynamic requirements. Four parallel-running channels each with a bit transfer rate of 622 megabits per second according to the ATM (Asynchronous Transfer Mode, the basis for the broadband ISDN) principle were implemented in this way.

Based on these results, the second phase of the photonics program is focusing on specific system developments. For example, transmission systems having bit transfer rates of at first 40 and later 100 gigabits per second, optical amplifiers for wavelength regions that have not been able to be covered until now (the blue region of the spectrum), as well as optical switching networks for public switching, are goals. Massively parallel optical interconnection systems for high-performance computers are an additional emphasis.

However, the developable potential of optoelectronics depends strongly on the integration of components on a substrate. Similar development is taking place here as in the case of microelectronics 10 years ago, when it began with packing densities of a few thousand transistors on a chip. Today there are millions.

The trend toward monolithic integration is governed by demand. If this demand is sufficiently high, costs will drop sharply after the pattern of microelectronics. Of course, the development of microelectronics has also shown that new requirements first arise because of new low-cost products.

Germany: RWTH Develops Laser Triangulation Technique

95WS0270A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German No 56, 20 Mar 95 p 10

[Article by sel., Aachen correspondent: "Contactless Measurement of Wall Thickness of Extruded Preforms;" "Researchers in Aachen Are Working With Laser Triangulation and Linear Processing Unit"]

[FBIS Translated Text] A procedure for measuring the wall thickness of transparent work pieces by the laser triangulation method has been developed at the RWTH [Rhine-Westphalian Institute of Technology] in Aachen. A semiconductor laser in the measuring head produces a light spot on the preform wall at a definable angle of incidence. The light beam splits here into two parts, one being reflected and one being absorbed. The reflected part appears as a light spot on the outside preform wall surface, while the absorbed one is back reflected by the inside surface so that a second light spot appears on the outside surface.

"The essential advantage of using a laser for this task is the excellent focusability of monochromatic light emitted by it", explains Prof. Walter Michaeli at the Institute of Synthetic Materials Processing. This makes it feasible to produce light spots smaller than 10 nm in diameter. For practical purposes one may prefer using semiconductor laser diodes. The wavelength of the laser radiation should lie within the infrared band within which the sensitivity of a CCD (charge-coupled device) camera has a maximum.

The CCD flat-top camera sees both light spots. With the distance between them thus determined and with the physical as well as geometrical boundary conditions known, an image processing system can then compute the local wall thicknesses in accordance with appropriate algorithms. The operation of such a measuring system is admittedly encumbered by changes of the boundary conditions in the blow molding process due to temperature fluctuations, due to vibrations, due to changes in the optical density of thermoplastic materials, due to schlieren formation on the surface, and due to oscillatory movements of extruded preforms.

For recording the entire wall thickness profile of a preform within a short time, moreover, the measuring head is mounted on a linear image processing unit. A synchronizing element must be integrated while a marked surface element is being traced. Aided by the camera, the image processing system identifies the location of a light spot and computes its anticipated position during the next measurement. At the same time the measuring head moves into the corresponding new position.

Each time a picture is taken the distance between the two laser light spots is again determined and so is thus the local wall thickness of the preform. The mechanism must necessarily have a high-speed computing capability, inasmuch as image data need to be evaluated very fast.

The method has already been tested in one of the Institute's blow molding plants. The report says that precise contactless wall thickness measurements can be made by this method, also that it can be used for inspection of 2-10 mm thick preforms of opaque materials. Further work is being done to ensure a still higher precision of measurements.

Germany: Laser Mass Spectrometer Measures Exhaust Gas Components

95WS0270B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German No 56, 20 Mar 95 p 10

[Article by eka., Munich correspondent: "Quick Analysis of Exhaust Gas Components"; "Researchers in Munich Are Developing Laser Mass Spectrometry"]

[FBIS Translated Text] For detecting the presence of various substances and determining their concentrations in exhaust gases from combustion engines, researchers at the Munich Technical University have developed a method of measurements which combines mass spectrometry and absorption spectrometry with use of ultraviolet laser light.

The task of determining individual components in a mixture of various gases becomes difficult as their concentrations change continuously in the course of the

combustion process, "often even within a time shorter than a tenth of a second," reports Dr. habil. Ulrich Boesl from the Chair of Physical Chemistry I at the Munich Technical University. The goal of the development work was to make it possible to analyze the exhaust gas components not only separately but also several of them together during the same measurement so as to be able to discern the influence they exert on one another.

Mixtures of substances do, of course, often contain different molecules having equal masses. Mass spectroscopy is, therefore, not adequate for this application. Ultraviolet spectroscopy is then resorted to: different molecules and atoms each absorb radiation of a different characteristic wavelength so that, when selectively excited by doses of energy, they eventually form identifiable ions. As the source of ultraviolet light can be used by any among a large variety of tunable lasers emitting pulses of 10 ns duration.

The research team has already developed ionization schemes for 25 kinds of molecules of special interest: among them formaldehyde, ammonia, methanol, sulfur dioxide, benzene, toluene, xylene molecules. With the laser emitting pulses at a 100 Hz repetition rate it is possible to make 10 measurements per second. In this mode of operation one can register even individual ignition events in the engine and plot the temporal concentration profile of the exhaust gas, even within a single engine cycle.

This laser mass spectrometry is to be applicable to tasks beyond the originally intended one. For instance, catalysts could be tested by this method for effectiveness. The research team will also use this method for determination of aromatic compounds in air. It is, moreover, meant to make possible continuous quick dioxin determination in metal processing plants.

JESSI Project Develops Advanced Wafer Tester

MI3103124995 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 20 Feb 95 pp 19-20

[Unattributed report: "Wafer Tester to Enhance Process Control in Semiconductor Fabrication"]

[FBIS Translated Text] A modern tester for silicon wafers whose performance far exceeds that of methods in current use has been developed under JESSI [Joint European Submicron Silicon Initiative] project E 106 ("Wavelength Dispersive X-Ray Fluorescence Wafer Analyzer"). It can be used both in commercial semiconductor factories and in development laboratories and is an important aid to optimizing output and performance parameters for a microelectronic device.

The SPW2800 wafer tester has been specially developed as an aid for process engineers in establishing the concentration of the different elements present in a particular sector of a wafer. It uses the established XRF (X-ray fluorescence) method: When an object is struck by an X-ray, it reflects fluorescent light. The spectrum of this light is analyzed, and the results then make it possible to identify the elements present in the sample and to establish their distribution.

The SPW2800 can not only identify almost all the elements in the periodic system—from beryllium to uranium—but can also measure their concentration within a range of 100 percent (the pure element) down to just a few ppm (parts per million), and in many cases even less. This is of great importance to engineers in semiconductor fabrication, as an enormous variety of elements, such as boron, phosphorus, aluminum, tungsten, and oxygen, are used in chip manufacturing, often on surfaces of less than one square micrometer. Nevertheless, the uniformity of the individual process steps must be guaranteed over the whole surface of the wafer.

The SPW2800 can be used to analyze nearly every layer in semiconductor fabrication, even silicides and salicides [Salizide] that contain metals such as titanium and cobalt, phosphorated polysilicon, nitrite layers, impurities, or etching residue. The following are examples of typical tests:

- —analysis of layer thickness and copper content during aluminum coating, which usually takes less than two minutes with the new process;
- —analysis of the thickness and the boron and phosphorus content of the boron-phosphorus-silicate layer, which takes less than three minutes and is accurate to 10 times less than the permitted manufacturing tolerances.

This new instrument, which is intended primarily for modern production works using 8-inch wafers, is an outstanding example of how companies from different sectors of industry can work together to good effect on JESSI projects. The partners in this project were Philips, LETI [Laboratory for Electronics and Data Processing], and SGS-Thomson Microelectronics: Philips as the inventor of XRF and leading supplier of industrial and medical X-ray equipment, LETI as a major semiconductor research center, and SGS-Thomson Microelectronics as one of the largest semiconductor manufacturers in Europe. By pooling their know-how, they were able to develop a tool fully tailored to the needs of the semiconductor industry and which gives a degree of precision, flexibility, and user-friendliness not previously to be found anywhere in the world.

European Microelectronics Trends

MI2803101095 Milan IL SOLE-24 ORE (INFORMATICA Insert) in Italian 17 Mar 95 p 3

[Unattributed report: "The Challenge is with the United States and Japan"]

[FBIS Translated Text] Europe has not missed the microelectronics train. "The European semiconductor manufacturers," stated JESSI [Joint European Submicron Silicon Initiative] Office Director Hans Meyer at the "Microelectronics Toward the Year 2000: Prospects and Developments" conference, "have overcome the technological gap with their competitors and have succeeded in generating profits. The past years have been a continuous expansion despite the economic crisis. The growth rate in 1994 was 35.6 percent over 1993."

According to Meyer an additional effort is now needed to consolidate and capitalize on the positions that have been achieved. A conquest that should not only be attributed to improved market conditions over the past 18 months, but above all to continuing investments made at the end of the previous decade. These were made despite many experts and politicians stated that Europe would have had to leave the microelectronics field to Japan and the United States.

"One of the merits of JESSI," stressed Meyer, "is that it did not let the politicians tell industry what it should do. It permitted the partners to keep the know-how and knowledge that had been acquired in their own hands. It obtained government funding exactly like other countries, from the United States to Japan, to Korea. In these countries adequate, targeted public support is considered to be a legitimate tool in improving the global competitiveness of industries. Particularly when it involves long term investments. Particularly when it involves projects and companies that have chances for success in a worldwide context."

Europe currently has these chances in the various applications sectors cited in the Bangemann report calling for a strong semiconductor industry. It possesses leading-edge chip sets for digital audio transmissions, and for GSM (global system for mobile communications) and ATM (asynchronous transfer mode) technologies. And it finds itself in a leading position in the field of digital television.

"Moreover," observed Enrico Villa, in charge of outside technologies and managing director of SGS-Thomson Italy, "the economic indicators as well as the order/revenue ratio reveal a prosperous situation and excellent prospects. Already last year demand was so high that it was difficult to keep up supply. In Italy too, computers are the market segment that has absorbed most of the components sector, but the diffusion capability of microelectronics in new sectors is such that it seems to have put a stop to the cyclic trend of the past. Experts therefore foresee an increase in the semiconductor market share of European industries from 9 percent in 1994 to 15 percent in the year 2000." The year when worldwide revenues in the sector should exceed $200 billion. This figure is double that of last year.

To achieve such a growth, many factories will have to be built throughout the world, between 15 and 20 each year from now under the end of the decade. A medium-large company will therefore be obliged to build a manufacturing plant every 18 months, with a yearly investment of $700 million, amounting to 17-20 percent of its own revenues.

"Our company," said Villa, "is already investing heavily in Italy. The construction of three large plants for 8-inch sets, one of which in Catania, is currently underway and 800 people have been hired over the past 18 months. This is equivalent to the staff of a new factory. All this despite the fact that our country, due to a lack of flexibility and loan costs, does not appear to be particularly suited for investments of this range."

According to Marc Vodovar, worldwide market research manager at Texas Instruments, it will be absolutely necessary to build factories in European countries where a large part of the production has already returned. "This is because," he said, "time to market a currently a crucial factor for success at least as much as loan costs. Consequently the emerging European markets cannot afford to buy components in Asia. The development of this continent will be primarily linked to the demand for electronic products from the same continent and this put the United States and Japan at a disadvantage, not Europe."

Once again, according to Vodovar, Europe will play a leading role in emerging markets for GSM cellular telephones and DSP (digital signal processing) that transforms analog signals to digital signals to reduce compression, transmission, and decompression costs. In 1994 Europe held a 28-percent share in the DSP segment, while the share for the entire semiconductor market has not reached 20 percent.

"The leading industries of our sector," addded Vodovar, "are not equipped to cater for the emerging markets, just as they are not equipped to cater for small- and medium-sized companies." He therefore agrees with Villa in considering that distribution will play a decisive role.

The distributors are aware of this. It has been confirmed by both Avnet Europe Added-Value Business Director Simon Butson and Eurodies President Rolf Thurnherr. "The role of the distributor," says Thurnherr, "has changed. While in the recent past it was sufficient to meet orders, the market is now calling for technical know-how, a coherent strategic approach, quality, and reliability. And services. These account for 80 percent of our company activity. Consequently training is needed, not only for sales staff and technicians, but also for clients. Primarily for those who find it hard to keep pace with the rapid evolution of technologies."

As ES2 (European silicon structures) Managing Director Bernard Pruniaux observed, it is difficult for small- and medium-sized companies to keep up, not because they are not capable of inventing new products, but because they are not able to make investments in design tools.

"A solution does exist," said Pruniaux, "and this also holds true for large-scale companies. It consists of writing the behavioral description of the chip being designed in VHDL (very high integrated circuit hardware description language)." This language was developed for the U.S. Army and not only makes the purchase of sophisticated software tools unnecessary but also allows for a description that is so precise it makes any misunderstanding impossible. With this any errors and related correction costs fall under the responsibility of the semiconductor manufacturers.

Germany: Sharing Plan Reduces Microstructure Production Costs

MI3103125295 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 20 Feb 95 p 21

[Unattributed report: "Sharing Scheme Lowers Microstructure Production Costs"]

[FBIS Translated Text] The Karlsruhe Research Center's LIGA (which stands for lithography, electroforming, second cast technology) process can now be used to manufacture minute structures of practically any lateral shape out of metal, ceramics, or plastics. The research center is now offering industry a sharing scheme, referred to as LEMA for short, that considerably reduces production costs for the desired microcomponents.

The LIGA process provides maximum precision in the manufacture of tiny components with typical measurements in the micrometer range, which are used in, for instance, the micromechanics, micro-optics, sensor and actuator, chemical, medical, and biotechnology sectors. However, the sophisticated production process makes for high production costs when production runs are small. The research center is now offering interested parties from industry, science, and research a sharing scheme that goes by the name of LEMA (LIGA products for several users) and makes it possible to produce different microstructures simultaneously on one mask. The manufacturing costs are thus shared by several users and are consequently substantially lower for each individual user.

With mask sharing, an established practice in microelectronics, the client designs the desired microcomponent in the form of a drawing of CAD [computer-aided design] program. The research center makes the requisite masks, on which several clients' structures can be accommodated. Each user has one or more 0.5 x 0.5 cm areas at his disposal for his microstructures. The number of items is irrelevant in this respect, as the client is charged per area "ordered." Each area costs just under 1,000 German marks. Once the samples have been proved viable, they can go into economic production using the second cast process. Industrial companies from the instrument-making and optics sectors are already taking advantage of mask sharing.

Siemens' Knorr on Semiconductor Market, Technology, Future

95WS0255A Munich ELEKTRONIK in German 21 Feb 95 pp 23-25

[Interview with Juergen Knorr, director of semiconductor division for Siemens AG: "Unusually Good Year for the Semiconductor Industry"]

[FBIS Translated Text] **The semiconductor industry had an unusually good year last year worldwide. According to preliminary results from the market research company Dataquest, the world market for chips and other semiconductor components rose to significantly more than $100 billion for the first time in 1994. Sales of approximately $110 billion achieved by the industry correspond to a rise of 28 percent, indeed a record result. The European semiconductor industry has been able to find its feet again under such favorable conditions: all three leading semiconductor manufacturers in Europe are in the black. The greatest gains have been made by the semiconductor division of Siemens AG, which continued to grow disproportionately by 43 percent last year, according to the company report. We spoke with Juergen Knorr, a member of the board of directors of Siemens AG and director of the semiconductor division, about the reasons.**

[ELEKTRONIK]: Siemens' semiconductor division achieved a turnaround within a very short time after a drastic restructuring program: how did you do it?

[Knorr]: First of all: what has been going on in Siemens' semiconductor division over the last 10 years? We were far behind the world competition, about four years behind, and we had to catch up. And this catching-up race was approached in two phases; now we're in a third phase.

So first there was Phase 1: Between 1984 and the end of the 80's we were catching up in technology—CMOS [Complementary Metal Oxide Semiconductor] production technology, risk distribution through strategic alliances (with Philips in the MEGA project, with Toshiba in production technology, then later joint projects with IBM for the 16 MBit and 64 MBit DRAM [Dynamic Random Access Memory] , then trilateral cooperation with IBM and Toshiba for the 256 MBit DRAM).

The second catch-up phase was from 1991 to 1994—the restructuring program which you mentioned. Break-even had to be achieved by passing from preparatory studies to development. We made our product portfolio leaner, sorted it out and focused on what we really can do and want to do.

For example, some things connected to standard logic, old microprocessors, peripheral components, and bipolar components were out of date. So we focused on four business groups: the first consists of special chips for telecommunications (language, data, images), for consumer electronics, for the automotive industry and for industrial applications. The second includes standard IC's such as storage, microcontrollers and the kinds of products which are not system-driven but cost-driven, with the motto "high tech, but low cost." The third group is discrete components, almost exclusively SMT components, and power components. The fourth group consists of optoelectronic components in the visible and infrared range, detectors, intelligent displays, LED's, optocouplers and all the products which are used for glass fiber communications.

Now, in the third phase, we want to grow. We have reorganized production, we have closed two less productive production lines (both in Munich). We have brought this production to Villach, we have developed Regensburg, we have built up a production site in Corbeil-Essonnes together with IBM, we have invested in Malacca and Singapore and will be starting in Dresden in 1995.

[ELEKTRONIK]: Are these changes technologically determined or do they come from the market?

[Knorr]: Both. "Bring technology to application" is our motto. Siemens has transformed itself from a company which is often very technologically driven to a market-oriented company. In the semiconductor division we are focusing on "key account" managers who have special knowledge in certain application areas: in telecommunications and information technology, in consumer electronics, in automotive and industrial electronics.

[ELEKTRONIK]: Would you say that part of the restructuring was more marketing orientation?

[Knorr]: Exactly. We are addressing a "global market," but "each business is local." A good house technology is an important, essential prerequisite for that. Finally, we also want to set technological milestones for our customers.

[ELEKTRONIK]: Siemens just completed a very successful semiconductor year: sales rose by 43 percent (in DM), even more in dollars because of devaluation. But Siemens is still not seen worldwide as a great driving force—what can you say about that?

[Knorr]: After all, we had to create the conditions to be successful first! In the last fiscal year we made a not insignficant profit—now we can expand, and in fact we are doing so rapidly, more than the market yields on a global average. (Editor's note: In the business year 1993-94, the component field in general (semiconductors, passive components and tubes, electromechanical components) achieved profits of DM300 million with total sales of DM5.8 billion. Based on sales distribution, about fifty percent of that amount comes from semiconductors. In the previous year losses were about DM400-500 million.)

[ELEKTRONIK]: Can Siemens also play a role in the multimedia field?

[Knorr]: Of course! Siemens will play an important role there, because we are active in the fields of telecommunications and consumer electronics. In the multimedia sector there will still be the three media, telephone, PC and TV, and they will each implement each other's technologies in the future. The challenge lies in integrating these things into a network.

[ELEKTRONIK]: And what components will be used for that?

[Knorr]: We have established contact with one of the large network companies. Joint projects were agreed on. We want to offer products on the basis of existing standards (such as MPEG), using our existing ISDN [Integrated Services Digital Network] circuits and DSP's (digital signal processors). That will only work in cooperation with others, as you can see by the many cooperative efforts which have been agreed upon recently. Take Apple, for example: they have a lot of experience in computing, but no experience at all in telecommunications. IBM also has a very broad and strong base in the computer business, but less in telecommunications. It is true that IBM had bought ROLM Communications, but then they sold it again to Siemens—and Siemens has now successfully incorporated it into its company. These are our strengths—and this is where we can successfully share the burden of development wiht partners.

[ELEKTRONIK]: How important is DSP technology for you?

[Knorr]: Very important. We are working successfully here with the DSP Group. We use cores from the DSP Group, and our customers say that there are no better DSP's for telecommunications and data processing.

[ELEKTRONIK]: Is your investment in Dresden a driving force for all these new technologies?

[Knorr]: We will start up the Dresden Microelectronics Center with 16-Mbit DRAM (now being produced in France) and then convert to 64-MBit and 256-Mbit storage and logic circuits. We believe that multimedia IC's can also be made in Dresden; for one thing, we need starge capacity on the chip there. The major applications are where moving pictures need to be processed.

[ELEKTRONIK]: When will something like that come along?

[Knorr]: From about 1997—then gradually the chips will be more and more highly integrated.

[ELEKTRONIK]: Will an IC be able to contain different technologies?

[Knorr]: You don't only need to have good ideas, you also need the ability to actualize them! New features will be added to the TV set, to the good old telephone: these depend on the strengths of the various manufacturers and then migrate step by step to the middle, where they will then come in contact with the PC manufacturers, consumer electronics producers and telecommunications producers. There will be no "pure," exclusively multimedia companies, at least not among the major companies. And video conferencing is not a mass market thing right now, more bilateral, to avoid long trips.

[ELEKTRONIK]: Back to Dresden: what about a possible partner there?

[Knorr]: We would like to have a partner, but don't necessarily have to have one. We are just discussing this question, but there is still time before the factory starts running at the end of the year. We want a real partner who can also contribute something to production knowhow, not just somebody who sees the partnership as a pure capital investment.

[ELEKTRONIK]: And who would be your favorite?

[Knorr]: Toshiba and IBM are already our partners in the technologies involved at Dresden, so that it will not surprise you that we are looking at them first.

[ELEKTRONIK]: How do you see the "new role" of the European semiconductor industry?

[Knorr]: The Americans are still further ahead in globalization. That is one of the challenges for the next few years, to go from "regional player" to "global player." That requires strong growth first of all. We proved last year that we can achieve that.

[ELEKTRONIK]: Mr. Knorr, you are also a member of the board of JESSI [Joint European Submicron Silicon Initiative]. How will things go with JESSI?

[Knorr]: JESSI has emerged as important and very successful for silicon microelectronics. Something of this kind should be continued when the project expires in 1996, not necessarily as "JESSI 2," but as a continued idea. Of course, this depends on the governments and the EU in Brussels. The strengths of the participating companies should be used, for example Siemens' competence in DRAM, but also the various technological focal points of the semiconductor companies.

Dutch Research into Anachronous Microprocessors Detailed

95WS0250B Rotterdam NRC HANDELSBLAD in Dutch 9 Mar 95 p 6

[Article by Rene Raaijmakers: "Clock Velocity Zero"]

[FBIS Translated Excerpts] [passage omitted] Virtually all commercially available chips have clocks. An indication of 100 MHz on a computer with a Power PC or Pentium indicates that the clock in these computers tick 100 million times a second. In many chips, this action takes up 40 percent of the energy used when the processor is working at full speed. But the energy-wasting machinery also continues to turn when nothing needs to be calculated.

No wonder that in recent years numerous ways have been developed to eliminate the clock completely or partly in microprocessors during periods of rest. In *laptops* (small lap-held computers) and *notebooks* (even smaller PC's with limited possibilities) this kind of system is very common.

But in the meantime there are also researchers who want to make their chips completely independent from this energy-guzzling operating schedule. It is apparently possible to make non-clocked, so called *asynchronous* chips. Their attractiveness is that they extend the lifespan of batteries in, for example, walkmans and mobile phones. Furthermore, researchers claim that they save costly silicium surface. In some microprocessors, the clock wires take up as much as 25 percent of the space.

In November 1993, the first sound with asynchronous chips was produced by Philips Research in Eindhoven. It was the sound of Dire Straits coming out of an experimental DCC [Digital Compact Cassette] recorder. In it, the chips had been executed in asynchronous techniques for the purpose of correcting errors. In conventional recorders, together with the mechanism and the reading head, these chips represent the heaviest draw on the batteries. The alternative chip set proved to use up 80 percent less energy than the clocked version. However, the chips were still too expensive for application because their surface was twice as large.

But in the meantime a great deal of improvement has taken place. "The second version is twice as cheap, twice as fast and four times as economical in energy," said Philips researcher Frits Schalij. Schalij explained that the current DCC chips are still a little more expensive than the chips used in the portable recorders. "Researchers of clocked chips have not been sitting still either. While we were working on the second version, they were already at the fourth generation. Because they have integrated more functions onto a single chip they managed to stay just ahead of us."

Steve Furber of the University of Manchester is convinced that asynchronous chips will break through sooner or later. "Not in desktop computers, but in the mobile phones of *personal digital assistants*." Together with Philips and the Universities of Groningen and Eindhoven, Furber's research group is working on asynchronous calculations within the European ESPRIT [European Strategic Program for Research and Development in Information Technologies] project. Meanwhile, Furber's group has developed the Amulet chip, an asynchronous version of the Advanced Risc Machines (ARM) processor. In mobile phones the ARM processors regulate, among other things, control functions and the digital compression and decompression of sound.

Early last year Furber demonstrated with the Amulet-1 that the asynchronous principle worked for ARM. However, at the time there were no energy savings yet. An improved project, Amulet-2, will go into production this summer. Furber is definite: "The Amulet-2 will use energy much more efficiently." Furthermore, simulations have indicated that Amulet-2 is three times as fast as its predecessor and twice as fast as the current ARM processor with the same production technology. "We hope that the combination of speed and energy savings will be attractive enough to make it useful."

This speed gain for asynchronous chips did not just fall out of the sky. In a clocked chip, the clock period is attuned to the slowest parts of the electronic circuit. If a clock were to tick more rapidly, at a given time some electronic functions would no longer be able to keep pace. Just as some train passengers would miss their connection if the NS [National Railroads] were to shorten the changeover times.

Hence, a clock must take the slowest participant in the calculation process into account. "This is why it has developed from a helpful conductor into a difficult dictator in the chip development process," stated Professor Martin Rem from the Technical University of Eindhoven, whose professional group does research into programming for asynchronous chips.

An asynchronous chip does not have this clock-imposed system. Each part can accomplish information processing at full speed and then transmit the data to the next unit. The asynchronous processes have something more akin to the alternating timbre of the tomtom. It is as if the mechanism runs along with the information current and adjusts the working rhythm to every part. [passage omitted]

"At Sun they are trying to demonstrate whether asynchronous electronics is a real alternative for powerful microprocessors," said researcher Jan Tijmen Udding from the National University of Groningen. Like Rem, Udding is working on models and programs for asynchronous calculations. "In addition to Steve Furber, Alain Martin from Caltech has also demonstrated that it is possible to make asynchronous microprocessors. But it is not yet clear whether they will be able to compete with the synchronous ones when talking purely about velocity."

Germany: Superconducting Magnet for Fusion Research Tested

MI3103124795 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 20 Feb 95 pp 13-14

[Unattributed report: "Polo Superconductive Coil Beats Previous Record 12 Times Over"]

[FBIS Translated Text] The superconducting poloidal field magnetic coil (Polo), a major component of international fusion research, has achieved a magnetic flux variation of 240 teslas per second (T/s) in pulsed-mode operation at the Karlsruhe Research Center's Karlsruhe Torus Test Facility (Toska). This means that the magnetic field strength changed by about 5 million times the level of the earth's magnetic field every second without the coil leaving its supercondictive state. This result exceeds the previous international record in this field by 12 times. Similar tests in other laboratories gave magnetic flux variations of 20 T/s as the magic threshold that could not be crossed without loss of the superconductive state. With this achievement, the Karlsruhe test coil has also met one of the major conditions required of a superconducting poloidal coil for use in the tokamak, the advanced magnetic plamsa confinement concept for fusion reactors.

Fusion research sets out to imitate the sun's production of energy in controlled conditions on earth and to generate energy from the fusion of atomic nuclei. The fuel used is ionized hydrogen gas, a plasma. In order to trigger the fusion process, the plasma must be confined within magnetic fields and heated up to temperatures in excess of 100 million degrees. The coils used to create the magnetic field must be superconductive, i.e., they must carry the electical current without loss. Only in this way does the fusion reactor achieve a positive energy balance.

The poloidal field coils, a prerequisite for the ignition and stable combustion of the plasma, are arranged in parallel to the doughnut-shaped reaction vessel and are subjected to heavy electrical loads by the periodic operation of the reactor, and also to heavy mechanical loads by the dynamic effects of the magnetic fields. Particular efforts are required at the design stage to guarantee the stability of the superconductive state and to keep losses due to induced eddy currents low.

The superconductor itself is of similarly complex design: 13 mutually isolated single copper cables are wound round an inner pipe, through which the cooling agent, liquid helium, flows at temperatures of around minus 270°C. They contain the niobium titanium superconductor in the form of thin filaments in a cupro-nickel alloy matrix in order to reduce any eddy currents. The whole structure is enclosed in a stable steel housing. The circular Polo has a diameter of 3 meters and has been operated at up to 24,000 amperes.

The test coil was developed jointly with industry (Hanau Vacuum Melting, GEC Alsthorn of Belfort) under the Euratom [European Atomic Energy Community] fusion program, and under the overall leadership of the Institute of Technical Physics (ITP) at the Karlsruhe Research Center. The experiments proved it possible to raise and lower the current strength in the coil by more than 10,000 amperes in two-hundredths of a second without the coil losing its superconductive state. This corresponds to the aforementioned magentic flux variation of about 240 T/s.

The Polo is currently undergoing further testing in the Toska plant. High short-time electrical ratings (about 320 MW) are set in order to produce rapid variations in magentic flux. The researchers from Karlsruhe and Siemens in Erlangen have jointly developed a high-power circuit with which 320-MW output pulses can be generated by rapidly discharging the energy stored in the magnetic field, with electric potentials up to 22,000 V at the Polo.

The Polo project know-how and results represent a major contribution to the superconductive magnetic field system for the international Tokamak ITER [expansion unknown] fusion project currently planned by the European Union, Japan, the Russian Federation, and the United States.

Germany: Role of Research Reactors, Plans for New Reactor in Garching

95WS0292A Duesseldorf HANDELSBLATT in German 22 Mar 95 p 29]

[Article by osl, Munich correspondent, under the rubric "Neutron Source"; "Scientists Want Improved Technology for Their Experiments. Debate over New Research Reactor in Garching"]

[FBIS Translated Text] **Since 1957 the physicists at the Munich Technical University have been doing basic and materials research with the aid of the neutron source in Garching, better known as the "Atomic Egg." A new neutron source is to replace the old research reactor in the year 2000.**

Munich, Tuesday 21 Mar 95—While reactors generating electricity deliver today 1,300 MW of power and the FRM-I "Atomic Egg" delivers at best only 4 MW, the new FRM-II is to deliver 20 MW [FRM (Forschungsreaktor Muenchen = Research Reactor Munich)]. For planning and construction of this reactor the Bavarian Provincial Government has allocated a total sum of 720 million German marks [DM], with the approval of the State Parliamentary Budget Committee, and so the authorization process is now running its course. The project team "New Research Reactor for the Munich Technical University" plans to break the ground in fall 1995.

It is not yet quite certain whether this schedule can be met, because opposition is stirring. This time the opposition is not aiming at core meltdown or steam explosion, which surely can be prevented by properly planned

construction, but rather focuses on the cost and the desirability of this plant along with the bidding procedures. In the United States they even see here a conflict with the Nuclear Arms Nonproliferation Treaty.

The researchers at the Munich Technical University want this new reactor, because today's state of technology offers them means of attaining a higher neutron flux density and better facilities for experimental work. The reactor has a single fuel element, 70 cm long and 24 cm in diameter, containing 8 kg of uranium silicide—a highly refractory material.

The fuel element contains enough nuclear fuel for 52 days under full load, or five cycles annually. A high neutron flux density is attained by using highly enriched uranium, that is 93 percent of fissionable U-235 and 7 percent of nonfissionable U-238. The latter captures neutrons and turns into undesirable plutonium, an item of concern in the Nonproliferation Treaty and thus a roadblock to completion of the project.

The U.S. Government has threatened that it will not allow fuel to be delivered for the FRM-II. One may assume that deliveries will at least take place under the proviso that all the results of the forthcoming neutron research will in return be made available to the United States. By the way, in the U.S., construction of the ANS [American Nuclear Society] plant in Tennessee had been halted and their own neutron research thus effectively discontinued. For the time being, then, the FRM-II will be the only neutron source in existence containing highly enriched uranium.

At this time, however, there is in Europe still enough fuel available to last until about the year 2010. Furthermore, the Nonproliferation Treaty outlaws any restraints on exploration and production of atomic energy for peaceful uses. It also mandates provisions for exchange of equipment and materials as well scientific and technical data.

The treaty expressly calls for cooperation with countries not in possession of nuclear weapons like Germany, which has yielded its control of highly enriched uranium to the European EURATOM [European Atomic Energy Community] and the International Atomic Energy Agency. Besides, the FRM-II proponents emphasize, the uranium in the fuel element is so strongly bonded to the ceramic that it cannot be separated from the latter and, ultimately, there is not enough of it there for making nuclear weapons.

Along with broad basic research, this research reactor is also used for test and analysis under conditions simulating "nearly industrial" ones. Materials research is the broadest field of research in Garching. Neutrons irradiate materials and entire machines just as x-rays irradiate the human body. One can thus observe how in an automobile during starting the oil flows from the sump to the critical places.

Inspection of adhesive joints, seals, and soldered joints as well as testing for corrosion in air or space flight are done by neutron radiography more reliably than by other methods and moreover interference-free. Even valuable paintings can be so "irradiated" near the research reactor of the Hahn-Meitner Institute in Berlin.

Stresses in sheet metal, ceramics, and polymers, also in bone tissue, are being analyzed by this method. Particulars of chemical compounds and atom dynamics during melting, conductivity of semiconductors and superconductors, chemical reactions, and catalytic acceleration of processes can all be traced with the aid of neutron beams. "One or the other item can also be traced by other methods, but neutron scattering is consistently the better tool and without it our materials research would cease to be competitive," the physicists at the Munich Technical University assure us.

Especially important are neutrons for the semiconductor technology. In order to make silicon memory chips, thyristors, and processors, one dopes silicon in a targeted fashion with phosphorus, boron, or other impurity elements. Exceptionally precise and homogeneous doping is achieved by "neutron transmutation," the process which Siemens introduced in 1973 for the manufacture of thyristors. Today for the manufacture of semiconductor about 140 tons of silicon worldwide are being "transmuted" by treatment with neutrons and thus converted into NTD (Neutron-Transmutation Doped) silicon, a decidedly more expensive material but then also a better basic one for semiconductor power devices.

One speciality researched in Garching is medical neutron therapy. A tumor treatment has been developed jointly with clinics which for some tumors was found to be up to ten times more effective than all other treatments. A neutron beam is particularly helpful in the case of tumor growths after conventional irradiation or operation. So far in Garching more than 300 patients have been treated with neutrons more than 700 times, but with the FRM-II both patient treatment and current research activity could continue under much more favorable conditions.

German Research Reactors

Reactor	Type		Power
Garching	FRM-I	since 1957	4 MW
Juelich	FRJ-2	since 1962	23 MW
Geesthacht	FRG	completed 1963	5 MW
Braunschweig	FMRB	since 1967	1 MW
Berlin	BER-II	since 1992	10 MW
Garching	FRM-II	from 2000 on	20 MW

European Commissioner Promotes Research Coordination

95WS0181A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 41

[Interview with Antonio Ruberti, European Commissioner for Research, by Framboisette Jassogne; place and date not given: "Ruberti Urges Better Coordination of Research"]

[FBIS Translated Text] Antonio Ruberti, 68, a deputy representing Rome and former Italian minister of research, has been a European Union commissioner (for research) since January 1993.

[Jassogne] How much is budgeted for European research now?

[Ruberti] On 16 December, the calls for bids for specific programs under the fourth framework-program for Community research were all approved and issued. The scientific and industrial research community can thus count on concrete projects and financial support totaling ECU2 billion (13 billion French francs [Fr]). That's three-fourths of the budget planned for 1995.

[Jassogne] What's in the budget for aeronautics and space?

[Ruberti] The European Commission believes this is a very important sector, in part because of its role in technology development, but also because of its competitive problems. The Community has a dual commitment to aeronautics. First, some ECU340 million (Fr2.2 billion) is being allocated to aeronautical research via a variety of different programs (industrial technologies, telematics, transport). Also, environmental and nonnuclear energy programs yield benefits in aeronautics. Second, we are committed to coordinating the diverse financial resources and research activities in the aerospace sector. This is already happening, for example, in air traffic coordination at the European level, under the Ecarda program. It simultaneously coordinates utilization of available resources and collaboration between the European Commission, Eurocontrol, ESA [European Space Agency], and other national air traffic control authorities.

Similar coordination projects are under way in the areas of safety and environmental protection. We also recall the accord signed in late 1994 by seven national aeronautical research agencies to coordinate their activities. We've made progress in coordination. But not enough.

[Jassogne] Do you think more coordination of research efforts is esential?

[Ruberti] Absolutely. That's why I've submitted a document which I consider very important. Its aim is to implement certain articles of the Treaty of Maastricht that have never been utilized (notably articles 130H, K, and L), and it includes an appendix citing examples of cooperation between various countries. The very first example is in the field of aeronautics, a sector which in a sense has already served as a testing-ground for cooperation between member states.

That document is now being studied by the European Parliament and Council of Ministers. France plans to bring it up for consideration during the first six months of its presidency [of the Commission]. The basic concept of the document is to eliminate the fragmentation of European research, which is one of its principal weaknesses.

[Jassogne] How do you explain the failures in general coordination of research?

[Ruberti] I have just cited several examples precisely to show that it is not a question of failures. For the fourth framework-program, we have been able to set up cooperation mechanisms in the Commission. Certainly it's possible to do more and better, but this is a positive beginning.

[Jassogne] Why the "little-by-little" strategy?

[Ruberti] Boldness is not enough. We must also build political consensus. In the past, as a cabinet minister, when Italy was presiding in EUREKA [European Research Coordination Agency] and subsequently the European Community, I proposed coordinating the national research policies. The opposition came not from the European Commission but from the member states, which were against this supranational coordination initiative.

In the last two years we have made advances in this area. Which was never possible during the 10 years of the previous Community research framework-program. Spurred on by the bitter competition between Europe, the United States, and Japan—which forced a response—we have brought the question of cooperation before the European Parliament and the Council of Ministers. The fundamental idea is to strike a new balance between internal competition and competition outside the European Union.

I should note that whereas the Treaty of Maastricht mentions "coordination" between member states, I have chosen to use the expression "cooperation looking towards coordination," because that permits a gradual and voluntary approach, one taking into account the political and industrial difficulties that obstruct such a process.

European Commission To Devise New Framework for R&D Aid

95WS0275A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 17 Mar 95 p 9

[Article by Framboisette Jassogne: "Brussels: Toward a Reshaping of R&D Aid"]

[FBIS Translated Text] Pursuant to the GATT agreement signed in December 1993, it is expected that the European Commission will soon adopt a new framework for research and development aid. But it remains for the

European commissioners to agree on the subject. Their agreement does not seem obvious in the case of Karel Van Miert, in charge of competition, or Edith Cresson, in charge of research.

In Karel Van Miert's opinion, priority must be given to economic and social cohesion within the European Union. Meaning that it is necessary to favor firms located in disadvantaged or peripheral areas. And to help them, Van Miert proposes raising the admissible ceilings for research and development aid from 25 percent of gross costs to 35 or even 45 percent. Taking an entirely different view, Edith Cresson feels that innovation does not occur in PME [small and medium-sized firms] in disadvantaged or peripheral areas. She says that on the contrary, it takes shape in the large European firms. With the result that more than anything else, "economic and social cohesion" is very likely to penalize European firms in comparison with their American and Japanese competitors. In Cresson's opinion, it is therefore necessary to give large industrial groups the possibility of access to Community manna, as is permitted by the GATT rules. Keeping in mind that the economic fallout from such an approach will also benefit the small firms.

Germany: Research Ministry Funds Advanced Materials Research

MI3103124695 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 20 Feb 95 p 9

[Federal Ministry of Education, Science, Research, and Technology announcement, dated 3 February 1995, of funding measures designed to speed up the introduction of new materials with surfaces upgraded by inorganic wet-chemical processes at centers for the conversion of research results into industrial practice]

[FBIS Translated Text]

Purpose

The exploitation of materials research and development results is largely thwarted by the fact that the user industries lack any or sufficient specific knowledge of the materials concerned and that no initial trials can be carried out with a new material or its production process for product innovation purposes. This difficulty is compounded by the fact that customized materials are often used in insignificant quantities and account for only a small proportion of the overall profit-making process. On the other hand, many new materials achieve pacemaker status in industrial production.

The purpose of the centers for research result conversion into industrial practice is therefore to overcome these obstacles and to speed up the conversion process in the area of material surface upgrading using inorganic chemical synthesis.

The "upgrading" of materials into components with enhanced properties and their use in the system as a major profit-making process is a central concern of the Federal Ministry of Education, Science, Research, and Technology (BMBF) funding for "New Materials for Key 21st-Century Technologies (MaTech)."

Specification

The BMBF materials research funding scheme has produced a large number of findings over recent years, particularly as regards material upgrading by inorganic wet-chemical coating. However, the conversion of many of these findings into widespread practice is still awaited.

It will be the job of the centers proposed in this announcement to speed up the conversion into practice of research results that have been brought to a sufficiently advanced stage of development. In practice, performing this task involves the following:

- application-specific elaboration of research results for the coating of materials and components using inorganic, wet-chemical methods (no electroplating, CVD [chemical vapor deposition] or PVD [physical vapor deposition] processes);
- demonstration of the technical and chemical feasibility of producing coated materials and their application-specific presentation up to the prototype component stage, quality assurance included;
- targeted development partnerships with innovative small and medium-sized enterprises;
- user staff training via temporary team work and staff exchanges between industrial and center personnel;
- public relations work designed to broaden the impact of the funding scheme.

General Requirements and Criteria

In view of the work involved, the centers concerned must have trained personnel and the relevant equipment. The centers will thus be set up at research institutes that are already highly qualified as suppliers of know-how, i.e., that meet the staffing and equipment requirements in the relevant field, perform basic and application-oriented basic research work, and work successfully with users on converting R&D results into practice. Both concrete interest on the part of industry and a sufficiently high medium-term application potential must be shown in the proposed topics and projects for speeding up conversion into practice. The centers will be funded by the BMBF for up to five years with progressively decreasing grants. Up to three centers will be set up initially. If these centers prove their usefulness and further demand emerges, another center could be set up at a subsequent stage. The host laender are expected to contribute significantly to the infrastructural measures required to set up the new centers.

Once the funding scheme has come to an end, the centers are to be capable of financing themselves solely out of their own earnings, largely from industry.

The preparations for and implementation of the funding scheme are the responsibility of the Materials and Raw Materials Research Project Manager, Juelich Research Center, P.O. Box 1913, D-52425 Juelich—tel. 02461/614891; fax 02461/612398.

Deadline for applications: six weeks after publication.

Germany's Technology Council Appointed, Begins Work

Members of Council

95WS0278A Duesseldorf HANDELSBLATT in German 27 Feb 95 p 4

[Article: "Kohl Appoints Technology Council"]

[FBIS Translated Text] Bonn, 25-26 February 1995—Federal Chancellor Helmut Kohl appointed the members of the long awaited "Research, Technology and Science Council." The federal government's desire with the council, whose establishment had already been decided last year and the appointment of which sparked impassioned debates on rules policy, is to intensify the cooperation among academia, the private sector and the government. Specifically, the council is to "develop trade options focused on the future that are subsequently to be consolidated and implemented in the Ministry for the Future."

From the government, in addition to Minister for the Future, Juergen Ruettgers, Kohl also appointed Economic Minister Guenter Rexrodt and Bavaria's Minister of Education and the Arts, Hans Zehetmair.

Private sector participants include Gert Becker, board chairman of Degussa AG, Christian Birr, executive partner of ORPEGEN Pharma Society for Biotechnological Research, Development and Production, Dieter Harting, executive partner of Harting Electronics GmbH, Swatch Watches Manufacturer, Nicholas G. Hayek, Berthold Leibinger, executive partner of Trumpf Machinery Works, Siemens AG board chairman, Heinrich von Pierer and Bavarian Motor Works AG board chairman, Bernd Pischetsrieder. Union representatives include the president of the IG [industrial trade union] for chemicals, Hans Rappe, and IG-Metallurgy's alternate president, Walter Riester.

Academia is represented by Wolfgang Fruehwald (president of the German Research Society), Hubert Markel (Department of Biology at the University of Constance), Juergen Mittelstrass (Constance University's Philosophy and Science Center), Dagmar Schipanski (Rector of the Technological University of Ilmenau) and Joachim Treusch, the president of the Association of Large Research Institutes. The constituent session is to be held on 22 March.

Tasks of Council

95WS0278B Duesseldorf HANDELSBLATT in German 22 Mar 95 p 4

[Article: "Ruettgers: Technology Council to Provide Major Impetus"]

[FBIS Translated Text] Bonn, 21 March 1995—Minister for the Future, Juergen Ruettgers (CDU [Christian-Democratic Union]) expects a major impetus for a future-focused policy in Germany from the new Council for "Research, Technology and Science." That, according to the minister in an interview with HANDELSBLATT.

The establishment of a Technology Council had already been decided last year. The project kept being put off, however, because of rules-policy misgivings opposing such an institution and because of the imminent election campaign.

Following appointment of the members of the council, the Technology Council finally convenes on Wednesday for a constituent session led by the federal chancellor.

According to Ruettgers, the group includes topnotch representatives from the private sector, government, unions and academia. Through discussions and debates they are to develop "trade options with a focus on the future" for Germany Inc.

The minister emphasized that this is no competition to his ministry but an important and necessary complement. It is an experiment, in dialogue with pertinent groups, to define how Germany is to continue to progress. Ruettgers emphasized that innovation in Germany cannot emanate solely from the government. Although support for research is an important factor, at least as crucial as "accounts, there should still be the proper funding."

The Technology Council, including such noteworthy representatives from the private sector as Siemens AG board chairman Heinrich von Pierer or BMW board chairman Bernd Pischetsrieder, possesses the necessary know-how to raise critical issues for the future and to provide appropriate incentives.

According to Ruettgers, the fact that the chancellor himself is involved in this issue indicates the priority that the administration assigns to policy for the future. Ruettgers does not buy the argument that the Technology Council is one more step in the direction of a Republic of Councils. Quite the contrary: he views the Council as a hub for dialogue. Even the envisioned operational methodology indicates this: the group is to formulate concepts and questions on specific critical topics. These would subsequently be consolidated and elaborated in the specialized departments of the competent ministries. The results are then to be resubmitted to the Council. After that the goal is to get unions, government, academia and the private sector in the same boat in specific areas crucial for the future.

Ruettgers has proposed the theme of "Information Society" as the Council's first operational focus. At its first session

the group will formulate and itself propose additional themes for upcoming months.

Ruettgers confirmed that he will assume executive leadership after the first session. Concrete activity, however, will occur in close consultation with the appropriate ministries, such as the economic or postal ministry.

Italy: Research Ministry Commission Approves EUREKA Projects

MI2803102795 Milan IL SOLE-24 ORE in Italian 12 Mar 95 p 5

[Report by Vera Viola: "Research, EUREKA Project Released"]

[FBIS Translated Text] EUREKA [European Research Coordination Agency]: It is starting off again. Finally, after being suspended for almost a year, the Ministry of Scientific Research Commission that assesses international research projects (Law No. 46/82) met to examine 13 projects (valued at 200 billion lire) that have already been drawn up and are only waiting to receive final approval by the ministry. Meanwhile, another 24 projects valued at 250 billion lire are pending approval.

After being suspended for a year, applied research projects for peaceful purposes only in conjunction with foreign companies are starting off again under Law No. 22 of 1987. The reasons for the suspension? "The former minister had not summoned a meeting of the Commission since April," explained Bruno Civitello, director of the Department of International Relations at the ministry. The reasons for this failure to call a meeting are unknown.

Perhaps they are related to a series of difficulties that emerged in the management of the EUREKA research programs. Starting with a lack of funding, due to the limit set for the allocation under Law No. 46; no more than 10 percent of the available resources. This limit was recently abolished with the inclusion of a norm in Decree Law No. 32 (Article 6 Para 7) of 8 February 1995.

"Originally, the 10 percent was a reserve for EUREKA projects," explained Giuseppe Colona, director of applied research at IMI [Italian Institute for Financing Personal and Real Property], the institute that manages the fund of Law No. 46. "Then, for no reason it was interpreted as being a limit that could not be exceeded. This has now been abolished however: We have 1 trillion lire available while 400 billion lire is sufficient for projects in abeyance."

However, first the lack of resources, then the bureaucratic and administrative paralysis lasting almost a year ended up by discouraging Italian companies to participate in EUREKA international research projects despite the substantial contribution amounting to 50 percent of projected overall costs. Consequently, from the 63 requests for funding presented in 1991, the figure dropped to only four in 1994. In fact the decrease also affected other facilitations under Law No. 46 probably because companies also cut back on research expenditure in times of recession, but in the case of EUREKA this was particularly drastic. "A real crash," commented Colona, "that was certainly due to the meagre resources and confused procedures."

This is not all. The delays discouraged not only Italian companies but also foreign ones, especially the French. In fact, France considered Italy its main research partner, particularly in the EUREKA projects. A title that has now been snatched away from us by the German, followed by the British, companies. Now however, the removal of the 10 percent limit and the summoning of the technical commission chaired by undersecretary Sergio Barabaschi, are starting to set the funding machine in motion again and hopefully it will be possible to make up for what has been lost, even in relations with France.

Meanwhile, in order to promote international projects, the Ministry of Scientific Research is thinking of further streamlining the procedures, after what was already achieved last year with a series of measures that, among other things, solved the difficulty of guarantees by replacing the bank suretyship previously requested from companies with other personal guarantees. "The objective we intend pursuing is that of assigning funds within eight months following the presentation of the request," added Civitello. "We would like to speed up the first inquiry, which precedes the international procedure for obtaining EUREKA status and the investigations later conducted by IMI."

Belgium: Flemish Government Approves Technology Projects

BR1004083195 Antwerp DE FINANCIEEL-EKONOMISCHE TIJD in Dutch 6 Apr 95 p 3

[Unattributed report: "Biotechnology Research Center Gets Green Light"]

[FBIS Translated Excerpt] The Flemish Government approved Minister-President Van den Brande's proposal to set up a Flemish Interuniversity Biotechnology Institute (VIB). The research center will receive a yearly budget of 920 million Belgian francs [BFr]. The Flemish Government also approved an information technology action program proposed by Van den Brande earmarking a BFr1-billion budget over three years.

Both projects were launched last year by Van den Brande. The VIB is expected to become what IMEC [Interuniversity Microelectronics Center] has been for microelectronics. The institute is scheduled to perform high-quality frontline research in the field of modern biotechnology, especially plant genetics and human health care. To this end Flemish researchers presently working abroad will be recruited. [passage omitted]

The information technology project is closely linked to the Telenet Flanders project, which aims to establish a

telecommunications network based on the cable network in Flanders. Almost the whole budget of the program will be spent on R&D in multimedia applications. Priority will be given to projects which are expected to yield direct applications for Telenet. In addition an information technology center will be set up for transferring information technologies to small- and medium-sized companies.

Dutch Improve Current Density in Superconducting Material

95WS0250A Rotterdam NRC HANDELSBLAD in Dutch 9 Mar 95 p 6

[Article by Dirk van Delft: "Small Dutch Breakthrough in Superconducting"]

[FBIS Translated Text] Natural scientists from Leiden, Amsterdam and Delft have requested a patent on a method to increase the maximum current density through a ceramic superconductor by a factor of two. This represents a significant step on the road to superconducting spools in industrial applications.

With ceramic materials, superconducting current containment, energy supply and transportation are possible at the temperature of liquid nitrogen (77 kelvin or -196°C), a commercially acceptable product. Meanwhile, the German wire manufacturer Hoechst has shown interest in the finding, and such companies as Siemens and American Superconductors are interested.

Superconducting in ceramic materials was discovered in 1986. Since then, research groups all over the world have thrown themselves into this phenomenon, for purely scientific as well as commercial reasons. An electric current without resistance does not produce heat and is technically very valuable. In the Netherlands, a national research plan, "High Temperature Superconducting" (as opposed to superconducting near the absolute zero point), was established in 1988 with the support of the Basic Matter Research Foundation and the Ministry of Economic Affairs. The characteristic involved in the patent request is the *critical current density*. This basic quantity, which is connected with anisotropy in the crystal matrix, is a limiting factor: if the current becomes too high, the superconducting condition will disappear. With the advent of new materials, critical current density at first increased rapidly but for the past few years there has been stagnation. At a temperature of 100 kelvin and a magnetic field of 5 tesla, the most favorable value would be about 1,000 amperes per square millimeter, a factor too low to be valuable for high tension current applications.

A joint project between the Kamerlingh Omnes Laboratory in Leiden, the FOM [Fundamental Matter Research Foundation] institute AMOS (Amsterdam-Leiden Materials Research in Superconducting) in Amsterdam and HREM (High Resolution Electron Microscopy) in Delft, led by Professor Peter Kes, has now succeeded in producing a superconducting material in which the critical current density does reach the commercial limit. Kes said: "We started from a combination of bismuth, strontium, calcium, copper and oxygen, popularly referred to as 'biscco.' It is so interesting specifically because, unlike other high-temperature superconductors, biscco grains texture well so that the small single crystals join together and the superconducting does not encounter any obstacles worth mentioning at the border planes. At Hoechst they have already learned how to make hundreds of meters' long wires from biscco, by pounding it in powder form into silver cylinders and then rolling the thing out."

Superconducting in layered ceramic materials can be disturbed by penetrating magnetic field lines. One solution is to fasten it at specific positions in the crystal (pins); then conducting electrons in the copper oxide planes can go by without hindrance. Dislocations or matrix errors are very suitable for pin centers. They can be inherent to the alloy but can also be introduced artificially. Kes stated: "With small quantities of oxygen vacancies there is enough pinning present in biscco to achieve useful current densities."

What Kes and his assistant, doctoral candidate Ting-Wei Li, were aiming for was to add a metal to biscco which would take the place of copper in the crystal, and thus obtain more pin centers. Kes stated: "We first tried iron, nickel and zinc and the result was a lower critical current density than in pure biscco. But with titanium it suddenly did succeed and the current density shot up. Hence, we believe that the titanium atoms ended up in the bismuth rather than the copper positions. A nice incidental fact is that by adding a little titanium—too much has the opposite effect on superconducting—the growth of biscco crystals is enhanced."

Reflector Oven

The latter occurs at a rate of 0.2 millimeters per hour in Dr. Alois Menovsky's ALMOS reflector oven in Amsterdam. The size of a typical titanium- biscco crystal is a few millimeters. The precise structure, including the location of titanium atoms, must come from Dr. Henny Zandbergen's high resolution electron microscope in Delft. He works rapidly and takes advantage of shrewd image improving techniques at the "top" of the frequency area. In his microscope, Zandbergen does see flat distortions in the crystal structure, which act as pin centers and are thus essential to an increased current density, but he has not yet reached the point in his analysis of being able to say with certainty whether the titanium has really settled on the bismuth positions.

For tactical reasons a patent has been requested for the plane matrix defect. The cost, 10,000 guilders, has been covered by an advance from NOP monies. Kes has one year to sell his invention on the market; otherwise, he will have to get a patent for 5 years, and that would cost six times as much.

But the first contacts with Hoechst have been made. "They supply the biscco powder, thus they might be interested in putting some money in our supplementary research or carry out part of it in their own laboratories. Now all the money for supplementary research must come from FOM, and because they do not want to finance a 4-ton squid, a sensitive detector, in addition to paying for a post-doctoral student and a researcher, we have submitted a request for this last amount to the Technical Sciences Foundation."

Other alloys besides biscco are also attracting attention. Last week, NATURE reported strikingly high levels of current densities in a specific class of mercury compounds which are superconducting up to above 100 kelvin. Kes noted: "This does not involve single crystals, whether neatly attached to one another or not, but thin films. Besides, it remains to be seen whether the doubling of current density, with the exception of a biscco single crystal, also appears in a drawn wire. What we have achieved is a significant first step, but do not believe that this will immediately give you some super spool."

EU Reticent About France Telecom, Deutsche Telekom Alliance's Atlas Project

95WS0269A Paris LE MONDE in French 22 Mar 95 p 15

[Article by Caroline Monnot: "France Telecom and Deutsche Telekom Respond to EU's Reservations"; introductory paragraph in boldface as published]

[FBIS Translated Text] **Threat: The Franco-German alliance in telecommunications is being weakened. The European Commission has expressed its reservations about accepting the Atlas joint project worked out by France Telecom and Deutsche Bundespost Telekom (DBT) in the field of data transmission services. A decision is to be reached on 6 May. To overcome the objections from Brussels, the partners will offer to accelerate the opening of their activities to competition from certain remote computer processing infrastructures. French business sees the German Government accelerating deregulation under pressure from the Americans, and it is afraid that the DBT will be tempted to go it alone. That is an "uncoupling" which Paris is refusing to consider but one which would call into question one of the few alliances between firms on the two sides of the Rhine.**

"The future of France Telecom will be decided within the next three years" is the saying at the headquarters of the French telecommunications operating company on Alleray Square. Three years is the—brief—period remaining between now and the complete elimination of protective telephone monopolies in Europe. On 1 January 1998, competition will be total. France Telecom, currently Europe's second-largest operating company after the Germans, must reorganize to ensure its presence in the new universe.

The method advocated by France Telecom's managers calls for giving their firm more autonomy and flexibility in the strategic management of its affairs by beginning a process of altering its status and opening up its capital. That strategy is being rounded out by a major international alliance with Deutsche Bundespost Telekom (BPT), a close ally culturally that shares the same vision and is developing Europe's largest telecommunications market across the Rhine. That policy was put in place 15 months ago.

What remained was to implement it. But nothing is proceeding as planned. Altering the company's status? Government authorities say it is necessary to do so. But that project was stopped cold following the strike in October 1993, which was supported by 75 percent of the employees. The [illegible]y by the SUD union—which is hostile to the "p[illegible]ation" of France Telecom—in the recent union [illegible] shows that the employees are still very concern[illegible] seeing their status as government employees jeopa[illegible]ized by such a move.

What about the Franco-German alliance? The Brussels Commission has expressed reservations about whether it satisfies Community rules governing competition. The Commission is to issue an opinion in particular on the Atlas project, a joint company that France Telecom and the DBT want to establish in the field of data transmission and other "value-added" services. Unlike "basic" telephone communication services, the sale of such services is already subject to competition. But the major rivals of France Telecom and the DBT, chief among them the British BT (formerly British Telecom), point out that competition is likely to be sidestepped because small private operating companies will have to use lines owned by the two allies in the two largest markets in Europe. That argument was repeated by Karel Van Miert, European commissioner for competition, in connection with the G7 summit meeting held in Brussels last 27 February on the subject of information highways.

The Commission has until 6 May to render its verdict. "DG-IV (Directorate General in Charge of Competition Affairs) is clearly hostile to us" is the feeling in Paris. "It is a problem of judgment. To evaluate the possible harmful effects on competition, it took as its reference market not the world market or even the European market, but the German and French markets," officials say regretfully. Some denounce the "effective lobbying" engaged in by the British from the BT. "From Great Britain's standpoint, any strong continental construction is considered a threat."

To remove prejudices, the French and Germans have decided on their response. They are proposing early elimination of the monopoly on data transmission infrastructures. Electric companies and highway and railroad companies could be authorized in both countries to sell value-added services on their own telecommunication networks—so-called alternative networks.

But a number of recent statements by German government officials, notably Minister for Economics Guenther Rexrodt, have given rise to doubts about the solidity of the alliance. Under strong pressure from U.S. telephone companies because of the size of its market and its geographic location, which makes it the hub of any alliance, Germany might be tempted to go it alone. It is emphasized that Deutsche Telekom is already involved in a process of partial privatization, whereas its French counterpart is lagging behind. That gap handicaps the alliance because the two partners plan to seal their union by an exchange of shares.

Those worried by the situation add that the plans for close cooperation between the two operating companies could suffer the effects of political changes resulting from the presidential election in France and from shifts in the balance of power between the Liberals (who favor strong competition) and the Christian Democrats (who are more moderate) in Germany. Furthermore, the resignation of Helmut Ricke, president of Deutsche Telekom's board of directors and a co-architect of the Atlas alliance project, has weakened the partnership.

Fear of a Franco-German "uncoupling" and of a DBT going its own way or renewing its U.S. ties may be only

an expression, in a different form, of traditional French doubts regarding the "German question." Officially, Paris wants to think so. But that fear is troubling people and making the coming decisions by Brussels all the more important. One of the few manifestations in the microeconomic field of the Franco-German alliance—which is more productive in the monetary, cultural, and diplomatic areas than it is at the level of business ties between the two countries—is being weakened. The threat is not a minor one.

Germany To Issue Operating Licenses

The German minister for posts and telecommunications is expected to begin issuing operating licenses for telephone services and networks to all applicants meeting minimal requirements, says the German economic daily HANDELSBLATT in its edition for 20 March. The number of future licenses would therefore be unlimited. That proposal is in line with a study conducted last February by experts from the Stanley Morgan Company, who feel that the German market could handle three major competitors and a multitude of local operating companies and niches controlling 34 percent of the German telecommunications market by the year 2005.

A week from now, on Monday 27 March, Minister for Telecommunications Wolfgang Boetsch is to present a plan drawn up by the government for the total deregulation of the largest telecommunications market in Europe. According to the reports in HANDELSBLATT, firms obtaining a license will be able to choose between operating their own networks, providing services, or doing both. Also according to the economic daily, the ministry is promising the competitors unrestricted access to Deutsche Telekom's networks at acceptable prices.

France: Teletel Plans Interactive Services for Users

95WS0294A Munich COMPUTERWOCHE in German 17 Mar 95 p 32

[Article: "France's Teletel Shaped Up for Interactive Services"; Subheadline: "Access to Compuserve and Internet"]

[FBIS Translated Text] **Paris—On the other bank of the Rhine, too, the online future is being crafted energetically. As reported in Paris, France's "Teletel" service for PC [personal computer] users is now being opened up. Concurrently, new services are also to be offered reflecting the increased power of the PCs.**

With its "Micro" (Teletel via computer) newsstand, the governmental telephone company France Telecom would like to keep global network providers and DV [data processing] firms such as Microsoft, Apple or Compuserve from monopolizing access to information services via computer in France. The word in Paris, however, is that cooperation by the Roulet firm with those companies is not precluded when the Micro newsstand is expanded.

Even now, for example, the majority of large U.S. providers are negotiating cooperation to this effect with France Telecom. Reportedly, it is planned even this year to make Apple's "World" service plus Compuserve's online service accessible via the newsstand. An Internet link too is projected, perhaps as early as midyear. In the future then, based on France Telecom's plans, the Teletel service may be accessed through a special telephone number via computer and modem.

France: Overview of France Telecom's Information Highways Projects

BR0604093195 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[First of 11-part series of 11 unattributed reports on France Telecom's projected experiments with information highways: "France Telecom To Carefully Invest 250 to 350 Million Francs a Year Mostly in Networks and Infrastructures"]

[FBIS Translated Text] France Telecom CEO Charles Rozmaryn and France Telecom Image Services Director Jean-Francois Latour told a news conference what the operator's commitments were with regard to the projects selected by the interministerial committee on information superhighways. A total budget of 1 billion francs [Fr] will be devoted to these experiments over the next three or four years. Work will be done in three fields: networks and infrastructures, intermediation platforms and multimedia servers, and applications. Charles Rozmaryn said that these experiments represent "an opportunity for France Telecom, an opportunity of seeing new markets on the horizon while the traditional markets, with the exception of radiotelephony, have reached maturity." The projects have a two-fold aim: "Testing new services and their ergonomics, testing technologies, and above all testing technologies for the distribution of high-speed services into the home."

Access networks are dealt with by four projects. First, a zone of 2,000-3,000 households will be connected up to Numeris. Second, ATM [Asynchronous Transfer Mode] will be tested within the framework of the European BATRU [Bringing ATM to Residential Users] project. Third, several fiber optic experiments will be carried out: the ARMOR [Reconfigurable Optical Monomode Network Architecture] pre-experimentation project and the best proposals received in response to DORA [Optical Distribution on an Access Network], France Telecom's international call for tender. The aim is to connect 50,000 to 100,000 subscribers on 4 to 6 sites to a fiber optic network beginning in late 1996. Charles Rozmaryn pointed out that for the time being there was no off-the-shelf product anywhere in the world to meet the required functional specifications. These platforms will be scattered throughout France and will be gradually interconnected over the very high speed ATM network. Fourth, there is the Camille [Asymmetric Copper Multiservice Integrated on Local Lines] project, an ADSL

experiment run to check whether or not this technology can be used to send at speeds of several megabits [per second] over the existing telephone network. The actual locations for these projects will be chosen in the summer.

It should be noted that the DORA project alone accounts for at least 50 percent of the planned investments.

According to Jean-Francois Latour, Fr300-400 million will be invested in intermediation platforms. These include the transition from the micro server to multinetwork, multiterminal teleservices, VT-Com development of a multimedia server, and the European Jasmin project offering broadband consultation services by mid-1996.

However, Charles Rozmaryn reiterated that "the services are at the heart of the problem. We must therefore invest in the services in line with our investments in infrastructure as we did for Minitel. At the end of the day we are prepared not only to welcome service providers on our networks but also to make a financial contribution in a partnership for the development of innovative services using new or even existing infrastructures."

In short, as France Telecom Multimedia Head Gerard Eymery pointed out, this means that the active partners being sought by France Telecom must not only have good ideas but also significant resources. Agreements have already been signed or are underway with major international groups such as CLT, Hachette, TF1, and Lyonnaise Communications. Partnerships are formed in each case by creating a joint venture such as France en Ligne or Multicable.

The applications being proposed fall into four major categories: public interactive services (accessible from a microcomputer or a TV set), professional on-line services, teleservices (education, health care, etc.), and audiovisual services (home shopping, game downloading, etc.).

France: France Telecom's New Infrastructure Technologies Explained

BR0604094495 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Second of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Networks—Four Experiments for New Infrastructures"]

[FBIS Translated Text] Of the 49 information superhighway projects which were finally approved as "public interest experiments," 10 were proposed by France Telecom, four of which are aimed at testing out new network technologies.

1. BATRU [Bringing Asynchronous Transfer Mode to Residential Users] Autoroutes [BATRU Highways] is the French version of two other European projects, BATRU Acts and BATRU Telematics, which will be proposed in the near future. It is aimed at testing end-to-end ATM [Asynchronous Transfer Mode] with home users. It will use the Paris-Brest axis, passing through Rennes and Lannion, as well as several optical distribution networks including Lannion's ARMOR [Reconfigurable Optical Monomode Network Architecture] network. It will be based on the French National Host, the test platform created by the National Telecommunications Research Center [CNET] within the framework of the European ACTS [Advanced Communications Technology Satellite] program which takes over from the RACE [Community Research and Development Program in Telecommunications Technologies] program. Three experimental applications will be tested out: interactive training for out-of-work industrial computing engineers, home shopping with interactive video sequences and the possibility of speaking to the salesperson on a high-definition video phone, and telebanking comprising home banking using the same tools as the home shopping application and a temporary bank branch offering financial consultancy aid and remote access to specialist financial services. MET (Matra Ericsson Telecommunications) will be the leading partner in this experiment which could run from mid-1996 to the end of 1998.
2. The ARMOR platform is based in Lannion. It comprises an optical fiber ATM transmission and distribution network as well as a services and intermediation platform which may soon include the Jasmin platform for broadband consultation services which also received official approval. The aim is to test out the carrying of telecommunications and multimedia services (consultation and news and video on demand) to the subscriber's door on an optical fiber network. This experiment will begin in 1995 and will be aimed in particular at companies specializing in content, home servers, and in-home terminals (the set-top box).
3. The DORA (Optical Distribution on an Access Network) project is France Telecom's most ambitious project in the area of information superhighways since it will drain half of the Fr1 billion budget which the public operator has decided to invest over three years. DORA consists in connecting 100,000 households or small businesses to an optical fiber-to-the-curb network by the end of 1996 to offer them telecommunications services (analogue telephone networks, ISDN [Integrated Services Digital Network] base and primary access, and Transfix at up to 2 Mbit/s), cable TV services, and multimedia services (consultation, VOD [Video on Demand], Near VOD and News on Demand). DORA will be launched in March 1996 on a pilot site of 500 to 1,000 hookups.
4. The Camille [Asymmetric Copper Multiservice Integrated on Local Lines] experiment. In other words it is an experiment in ASDL [Asymmetric Digital Subscriber Line], the technology launched by BT [British Telecom] which makes it possible to send digital data along copper pairs at 6 Mbit/s over a distance of up to

3 km. This means it would be possible to send two cable TV programs over the subscriber's existing telephone line. The experiment will begin in late 1995 in Rennes and Lannion with several dozen subscribers. In a second stage it will include multimedia consultation services for 500-1,000 users. It will use end-to-end ATM and the MPEG2 [Motion Picture Expert Group 2] compression standard.

All the other France Telecom projects are experiments in innovative interactive services on tried and tested network technologies.

France: France Telecom's Numeris Hub Scheduled To Open in Late 95

BR0604095495 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Third of an 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Numeris Hub To Open in Late 1995"]

[FBIS Translated Text] The Numeris hub should start up during the fourth quarter of 1995 and run for about a year. This will be France Telecom's first major project in the ISDN [Integrated Services Digital Network] field. The public operator is looking to trigger "a collective communication effort favoring access to clusters of multimedia services" and to promote "a new interactive space integrating text, data, photos, sound, images, etc." The hub will be a geographical zone of 2,000 to 3,000 volunteer Numeris subscribers, both home and office users, but the precise location has yet to be decided.

In the residential domain (family and private use) tests will be run on videophones, access to information or leisure services (TV, games, etc.), and the improvement of communications by image for the hard of hearing and the housebound. In the professional domain tests will be run on the integration of the smallest sites of a company in its internal private information network, teleworking and cooperative working using videophone kits (application sharing, blackboarding, remote assistance, etc.) as well as specific uses by certain fields of activity and trades (electronic trading, access to image information servers, telelearning, telemedicine, telediagnosis, etc.). A number of partners have already expressed the desire to see their products and services included in these experiments and negotiations are under way.

France: France Telecom's Kiosque Micro Service Presented

BR0604095695 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Fourth of a 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Intermediation Platforms and Multimedia Servers—'Kiosque Micro' Microcomputing with Telematics"]

[FBIS Translated Text] The Kiosque Micro service makes it possible to access the conventional French Minitel videotex services accessible from a microcomputer plugged into a telephone line, together with new microcomputing services. Speeds of 14,400 bps (a V32 bis modem) makes it possible to transmit images and, soon, sound.

These services take advantage of the user-friendliness of the microcomputer graphical interface. Consultations and transactions can be done on the microcomputer and the data received can be used more effectively.

No special subscription is needed to access the Kiosque Micro service. All that is needed is a microcomputer connected to the switched telephone Network (STN) on which a six-figure number is dialled, such as 36 01 XX XX.

The Kiosque Micro access service is available without subscription and the conditions and cost for accessing it are not server location-dependent. Micro Kiosque offers the functions of a telematics server, with France Telecom invoicing the user for all of the service and reimbursing the suppliers for the service part.

To encourage as many suppliers as possible to take this decisive step, France Telecom has waived subscription to this access for six months if they agree to the special conditions governing the service before 30 July 1995.

This stage is part of a general strategy for the development of open-ended intermediation platforms which will make it possible to host an increasingly diversified and personalized number of services for targeted customer groups. France Telecom Multimedia is already very active in collecting clusters of thematic services for use on Kiosque Micro and future platforms.

The following tables illustrate the respective positions of the different means of accessing Teletel according to typical speed and terminal parameters:

Access	Speed	Service	Terminal
Teletel	1.2 kbits/s	Videotex	Minitel + Emulators
High Speed Teletel	9.6 kbits/s	Videotex with or without photos	Minitel + Emulators
Kiosque Micro	14.4 kbits/s	Microcomputer Presentation with or without photos	Connected Computer

To accompany the development of Kiosque Micro, France Telecom will be developing what it has on offer in the future. In 1995, France Telecom will offer a customer software downloading service, an on-line help service, a micro services directory, and the electronic telephone directory. France Telecom will then distribute a diskette for access to these services. In the second half of 1995, Internet will be accessible from Kiosque Micro which will then support the IP protocol. Also during the second half of 1995 France Telecom will decide on the interfaces that will be used for its own services accessible

from Kiosque Micro. Before the end of 1995, an experiment will be run to test using Kiosque Micro with V34, 28,800 bps modems. In April 1995 new types of services will be offered since the opening rules governing Kiosque Micro will have been chosen by then in consultation with the service supplier associations and on the advice of the CST [Higher Telematics Council] for the amendment of contracts.

France: Jasmin To Offer Individual Broadband Consultation Services

BR0604104595 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Fifth of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Jasmin—Broadband Residential Consultation Services"]

[FBIS Translated Text] Jasmin is a service platform project aiming to offer broadband consultation services by mid-1996. This platform is based on different types of distribution network for residential customers: distribution system, multipoint optics, existing copper wire support, and coaxial, hertzian, and satellite networks.

At the head of each distribution network a front-end application enables access to the service and connection with the servers. It distributes information from the content servers and can keep the most frequently required information on local cache servers. The interconnection between the different content servers and the distribution networks is provided by an ATM [Asynchronous Transfer Mode] network. Terminals may be "multimedia microcomputers" or "set-top boxes" depending on the targeted users and services. The Jasmin platform provides mediation (service directory, access control, billing, etc.) between the service providers and the users. Finally, there are plans to offer the service providers resources for developing and hosting their applications. For example, tool boxes (MPEG [Motion Picture Experts Group], MHEG [Multimedia/Hypermedia Experts Group], etc.) could be made available to them.

An experiment entitled "Jasmin Initial Phase" will begin in mid-1995 on existing networks (connecting up STN's for the interactive operation and cable networks for the distribution). This will focus on individual sound and image bank consultation with high-level, TV-quality interactivity for remote catalogue consultation, news on demand, and detailed directory services. It will involve a limited number of users. A life-size experiment is scheduled for late 1996 (several thousand users).

In the long term, three types of service will be offered: audiovisual services such as news on demand (NOD) and films on demand, telematic services including animation such as home training, administrative guide, video information exchange services, etc., and services involving transactions such as home shopping and on-line video catalogues (directories, leisure, and commerce).

This platform was developed within the framework of an open partnership. Negotiations are currently underway with technical service providers or content providers.

France: 'France en Ligne' To Offer Clusters of Telecom Services

BR0604123795 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Sixth of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Clusters of On-Line Services: 'France en Ligne'"]

[FBIS Translated Text] Confronted with the ever-burgeoning supply, the need has emerged to regroup services in the form of "clusters" targeted at the particular needs of a category of user (information services and transactional services in the leisure sector, ordering music titles, the press, electronic games, etc.). France Telecom intends to be a driving force in this sector and is looking to join with a number of content partners. France Telecom has already joined forces with Bellanger-Filipacchi to set up the "France en Ligne" service cluster.

This offer is aimed chiefly at residential customers equipped with communicating microcomputers. In a second stage, it could be extended to include business users. It consists of offering a "cluster of services" based on the installation of a technical platform put together by France Telecom. A technical platform means a group of intermediation resources required to provide cluster services: identification, welcome and navigation functions, directory and guides, transaction management, invoicing, etc.

On an experimental basis the relevant access network is the telephone network. Depending on the results, it will be possible to extend the supply of services to other access networks, such as cable networks, while using the same shopping mall as a support for the cluster of services.

This project is being undertaken by the company France en Ligne [France On-Line], which brings together Bellanger-Filipacchi and France Telecom. Negotiations are under way with various companies that are active in supplying content in the leisure sector (music, books, etc.). Tests will be conducted in mid-1995, with the opening of the service scheduled for the last quarter of 1995.

France: On-Line Service Cluster Available on Cable Network

BR0604124095 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Seventh of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Clusters of On-line Services on the Cable Network: 'MulticabLE'"]

[FBIS Translated Text] France Telecom, in association with Lyonnaise Communications, is proposing to set up a service cluster known as "MulticabLE," which is dependent on the installation of a technical platform set up by France Telecom and which uses the high-throughput transmission capacity of cable networks. This offer is aimed at residential customers equipped with microcomputers and cable network subscribers.

The platform includes three main parts:

- the cable network equipped with a return channel on the cable;
- the "virtual village" enables navigation between the services in the cluster and houses part of the services, while also providing a group of horizontal services;
- the adapter card installed in the microcomputer.

The experimental site will be chosen in a geographical area of the Paris cable network. Depending on the results, there will be plans to extend the supply of services to other cable networks.

The services on offer cover several sectors: information services and electronic guides, transactional services, training and education, electronic games, the press, virtual museum, etc.

This project is supported by France Telecom and Lyonnaise Communications within the framework of the company "MulticabLE," which is currently being set up. Negotiations are under way with companies active in content supply, namely mail-order companies, electronic information, as well as manufacturers and services companies to provide the constituent elements. Tests will be conducted beginning in summer 1995, with the service scheduled to begin in the last quarter of 1995.

France: Infopro Professional Service To Test Market Platform

BR0604124195 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Eighth of a series of 11 unattributed reports on France Telecom's projected experiments with information highways: "On-line Services for Businesses—Business Services Marketplace"]

[FBIS Translated Text] The aim of this project is to experiment concretely with a market platform, chiefly to gain the user's view. This will be supported mainly by the Infopro project, and provide the following cluster of services:

- the Export Assistant, a marketplace for service suppliers in the export, languages, and travel industries;
- the remote-distance training services information desk. This entails setting up an intermediation platform for remote-distance training services. It will also be supported by Kiosque des Teleservices.

A number of services will be on offer, ranging from simple contact services (directory, brokering), as well as monitoring, confidentiality, identification, and security services, through to pricing, invoicing, and recovery services.

Infopro should gain easy access to the information and services executives need at their workplace: business directories, financial information, legal information, press information, timetable services for trains and planes, marketing information, and information on trade fairs and events.

This is an open partnership. Some are already rather advanced in terms of Infopro services (piloted by the subsidiary Questel-Orbit), Export Assistant (piloted by the subsidiary Translatel), and teletraining services, where partnerships already exist.

France: DEST To Develop ERNEST Multimedia Distance Learning Network

BR0604140795 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Ninth of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Teleservices—ERNEST: Multimedia Distance Learning Network"]

[FBIS Translated Text] The Directorate of Higher Telecommunications Education [DEST], which comprises six engineering schools and 2 management schools spread over a number of areas in France and one site in Poland, is going to create multimedia databases on its various sites which are interconnected by a high-throughput network: ERNEST (National Network for Higher Telecommunications Education).

ERNEST will use a Web-type protocol that should make it possible to navigate these databases with ease.

The ERNEST network will offer the possibility of experimenting with distance teaching and training services. The first courses on servers, together with awareness-raising and training exercises for teachers will get under way in the first half of 1995. The first experiments in real situations will be carried out during the 1995-1996 academic year. The system will be made widely available the following year.

A gradual approach will be taken. In certain cases it will simply be a matter of transferring course content, to which will be added sound, animated graphics, and animation. In other cases, it could involve setting up documentary bases linked to an expert system or offering animated replays of experiments in order to, say, arouse the student's interest and give something extra that cannot be found in duplicated lecture notes.

Each school will set up its own database in its areas of expertise. An automatic question generator will be developed in order to check that knowledge has been acquired. Students will be able to ask questions via mailboxes. The teacher will then reply—initially off-line, but there are plans to make the system able to reply automatically to questions asked by the students.

Continuing training programs will be able to benefit from ERNEST thanks to the consultation of knowledge bases developed within the framework of initial training. Special information could definitely be introduced into the system, if the need arises.

These bases will be very widely accessible, thus enabling a vast dissemination of knowledge. In the long term, cooperation with other institutions of higher learning could be planned. The network used abroad will be EUNICE (European Network of Universities in Information and Communication Engineering), which links some 15 universities in Europe.

France: Partners Negotiating On-Line Shopping Experiments

BR0604140995 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Tenth of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Audiovisual—Instant Telebuying"]

[FBIS Translated Text] This service will allow cable network subscribers to order—using their remote controls—the product presented on the teleshopping channel. The connection to the telematic server will be made via a Visiopass modem. The dialogue used to place the order will be done on the screen, using video insets.

The partners are currently negotiating. Experiments will be carried on the Caen cable network beginning in mid-1995. They will last between three and six months. Some 500 subscribers will be involved in the experiments.

France: Paris Cable Networks To Be Used for Downloading Video Games

BR0604141295 Paris AUTOROUTES ELECTRONIQUES in French 24 Mar 95 pp 1-8

[Eleventh of 11-part series of unattributed reports on France Telecom's projected experiments with information highways: "Downloading Video Games"]

[FBIS Translated Text] Plans are afoot to carry out an experiment in downloading video games to microcomputers over the cable networks in Paris, Boulogne, Neuilly, Levallois, Vincennes, and St. Mande. This experiment will use Visiopass terminals that allow data to be disseminated.

A partnership was set up with the Sony company and with Lyonnaises Communications (the network's commercial operator) for this experiment.

The experiment will take place sometime in 1995 for a period of about three months, after the technical experimentation phase which is currently under way. Some 500 subscribers will be involved.

France-US Joint Venture Established for Telecommunications Project

95WS0249A Munich COMPUTERWOCHE in German 3 Mar 95 p 4

[Unattributed article: "Brussels and Washington Put Obstacles in the Path of Telekom"; "Continuing Concerns About Atlas and the Joint Venture with Sprint"]

[FBIS Translated Text] **The plans of Deutsche Telekom AG concerning international alliances are still standing on feet of clay. This involves both the joint venture Atlas planned with France Telecom and the cooperation of both telecommunications giants with the U.S. carrier Sprint.**

Apparently, another veto from Brussels is threatening the former Post-Office company from Bonn. It comes on the heels of the prohibition of Media Service GmbH (MSG), planned with Bertelsmann and the Kirch-Gruppe. On the occasion of the G7 summit, the EU Competition Minister Karel van Miert stated flatly to the responsible German and French ministers that his agency continues to have grave concerns about the German-French joint undertaking Atlas.

The purpose of the joint venture, as van Miert was quoted, should not be to exclude other competitors from the market. It has been known that Brussels has had headaches with regard to a combination of the Datex-P service of Telekom with its French Pendant, the France Telecom subsidiary Transpac. Insiders assume that without extensive improvements, both telephone companies will not receive an operating permit for Atlas.

Furthermore, the uncertainty about the approval from the Cartel Office on the planned alliance between Telekom, France Telecom, and the U.S. carrier Sprint continues. This was made clear by a spokesman of the responsible U.S. oversight authority, the Federal Communications Commission (FCC). As the FCC representative emphasized, the Europeans had not done nearly enough to open their telecommunications markets to foreign vendors.

The most recent criticism from Washington refers primarily to the failed participation of the U.S. telecommunications company AT&T in the French government

computer concern Bull. AT&T retreated from the deal with Bull because the government in Paris did not want to loosen the monopoly for long-distance calls before 1998. Under these circumstances, said the spokesman, "Neither the French nor their European partners could expect special accommodations from the Americans." The Sprint-Telekom-France Telecom alliance needs to be blessed by both the FCC and the American Justice Department.

Germany Leads in European Information, Communications Market

95WS0249B Munich COMPUTERWOCHE in German 3 Mar 95 p 5

[Unattributed article: "The European ITC Market Grew by Five Percent in 1994"; "Germany Leads the Old World"]

[FBIS Translated Text] **The volume of the European market for information and communications technology (ICT) increased in the past year to about 530 billion German marks [DM]. Of this amount, users spent DM244 billion for information technology and DM286 billion for telecommunications equipment and services. The growth rate has almost doubled over that of the crisis year 1993 in the total market.**

For this year, the authors of the European Information Technology Observatory (Eito) expect an increase of just under six percent to DM562 billion. The organization traces the healthy growth of the European market primarily to the end of the recession that characterized the year 1993.

With the improved economic conditions, the user companies again have their eyes on growth so that previously postponed purchases of IT and communications technology have finally been implemented. Lower prices for commodity products—particularly in the PC sector—also contributed to a stable demand.

Great increase in network services

Users are increasingly concerned with the communications capabilities of systems. The need for advanced telecommunications solutions is exceeding, according to Eito, the expenditures for information technology. Particularly in the area of network services, the prophets expect good chances for vendor expansion. This sector grew in the past year by 12.3 percent. It should increase by 13.6 percent again in 1995.

The market for services is expanding considerably even in information technology by seven percent. However, the authors assume a smaller growth for the current year. The software expenditures, on the other hand, increased by 6.7 percent in 1994 and should increase by another 7.6 percent this year. The market researchers registered a positive result even in hardware sales. In the past year, the growth rate was 3.9 percent. In 1995, it should be 4.9 percent.

Disregarding telecommunications, the IT market in Europe increased by 4.4 percent. For the next year, an increase of 5.2 percent is expected. In this way, the total volume of the ICT market should run to DM562 billion.

Although the recession appears to have been overcome and all signs are again pointing toward growth, the European market lost volume in relation to the U.S. While the ICT expenditures in the Old World were 34.2 percent of worldwide expenditures in 1993, the European market had only a 31-percent share of the total volume of DM1.71 billion in 1994.

Aside from currency fluctuations, it was mainly the greater growth of the U.S. market, at 5.7 percent, that contributed in the past year to a 5.6-percent expansion in the world market. The volume in Japan, on the other hand, decreased even if not as greatly as in 1993. Accounting for currency fluctuations, the U.S. had about a 35-percent share of the world ICT market, Japan has 15.8 percent and the four tigers a share of 3.7 percent.

The national markets in Europe did not profit equally from the relatively healthy overall growth. Germany represented 28 percent of the European IT market and, with a volume of DM69.5 billion, the largest single market within the EU. The increase here was 3.7 percent. For the current year, the Eito prophets expect a positive result of 5.6 percent.

Germany-Russia-Ukraine: Dornier Participates in VSAT Network Project

95WS0249C Munich COMPUTERWOCHE in German 3 Mar 95 p 33

[Unattributed article: "Dornier Builds VSAT Network in CIS Countries"]

[FBIS Translated Text] Daimler-Benz Aerospace AG (DASA) has received a contract from Romantis GmbH to install two VSAT networks with a total of 1000 stations in Russia and Ukraine. The large contract is to be performed by the DASA Information and Communications Systems product area of Dornier in Friedrichshafen. The central stations of the star-configured VSAT networks are installed in Moscow and Kiev and operated by way of the Intelsat satellites. With the help of VSAT systems, voice and data services can be offered in the future over great distances, for example, from Bonn to Alma Ata.

German Pilot Projects With ATM Examined

95WS0255B Heidelberg NET—NACHRICHTEN ELEKTRONIK +TELEMATIK in German Jan/Feb 95 pp 22-25

[Article by Hermann Hartenthaler: "First Practical Experience: ATM—A Revolutionary Technology on the Test Bench"; first paragraph is editor's summary]

[FBIS Translated Text] **New multimedia applications and the constantly growing demand for bandwidth in LAN [Land Area Network] and [Wide Area Network] WAN are putting too many demands on conventional network technologies. ATM [Asynchronous Transfer Mode] promises a solution of these problems. Meanwhile, the first experiences with practical use of ATM are now available.**

Demands on the computer networks are constantly increasing. Workplaces are now increasingly equipped with powerful networked PC's [Personal Computers] and workstations. In addition, in some companies work is already being done on concrete strategies for the use of multimedia communications applications which are intended to increase productivity in the workplace. A prerequisite is that the networks and data transport systems also support these applications. In the field of long distance traffic, such demands cannot be solved satisfactorily even with technologies like ISDN [Integrated Services Digital Network] and DQDB (Distributed Queue Dual Bus). In the LAN field, there is a strong tendency to smaller and smaller network segments—to a radially-oriented cable structure with switched ethernets, for example. Nevertheless, these structures have major problems with adaptation to changing traffic phenomena.

However, new network technologies can only become established if their introduction is supported by universally acknowledged standards and a broad consensus among participating user and manufacturer groups. ATM technology is an example. While long-distance communications network operators have been promoting standardization of ATM for years in the ITU (International Telecommunication Union), several hundred manufacturers from various industrial branches have organized themselves in an ATM forum. And more and more users are relying on this technology as the basis for a unified network platform for the future.

Can ATM fulfil these expectations in concrete daily operation? Relevant pilot projects on a local scale and in long-distance traffic networks have been started all over the world in the last couple of years. The following article reports on the first practical experience in Germany and Europe.

Pilot Projects

ATM is characterized by a connection-oriented network technology with a radial connection between the end systems and central transmission. The necessary flexibility is achieved by making bandwidths available in accordance with need. Since ATM can be used with different types of glass fiber or copper cables, the cabling infrastructure can be flexibly designed on the tertiary level. In networking ATM transmissions with each other, all kinds of topologies can be used, from a simple chain to complete physical interstitiality.

The first applications of ATM technology were constructed primarily in the environment of universities and research institutes. The goal was to use ATM up to the end device and thus to make it useful for applications such as multimedia communication. Such developments have been pursued since 1989, in the Berlin BERKOM project (Berlin Communications Network) among others.

In many industrial projects people are now beginning to employ ATM in the backbone as a rapid and flexible transport infrastructure, for example in order to network conventional LAN's or to connect ISDN-TK plants with each other. The considerably more complex direct linkage of end devices is generally not anticipated until a later stage.

In the field of long-distance transport, very many network operators have started their first pilot projects worldwide. They are now in the process of connecting their ATM islands with each other internationally. In addition, in the case of network operators like Deutsche Telekom, initial consideration is being given, for instance, to catching up on the constant increase in ISDN traffic not by developing the ISDN infrastructure, but by investing immediately in a more powerful ATM infrastructure. There is thinking going on worldwide about the use of ATM extending to individual households in the initial video-on-demand pilot projects.

The German Research Network (DFN) is currently planning the construction of a national high-speed network which is based on ATM and 34 Mbps connections. The goal is to make a powerful infrastructure available to research institutes in Germany for the future.

In preparation for the use of ATM in commercial application fields such as medicine, printing or office communications, the Telekom daughter company DeTeBerkom and the project partners associated with it began as early as 1993 to purchase ATM products available in the marketplace and to investigate them intensively with regard to their practical utility.

The first concrete experiences with ATM products were gained at various exhibitions, fairs and conferences. At Cebit '93 a homogeneous grouping of ATM transmissions from the company Fore Systems was produced, and an ATM long-distance transport connection was linked to the computer center at the University of Stuttgart. The ATM cells were transmitted via a VBN linkage (transmitted broadband network).

At the Interop in Paris in October of 1993 the transfer from the ATM networks in Berlin and Stuttgart to the

MAN (Metropolitan Area Network) based on DQDB was demonstrated for the first time. This in turn was connected to a Telekom MAN at the Interop in Paris.

At Cebit '94 the ATM transmission of Telekom's national ATM pilot project was activated by Siemens in Berlin and connected with the fairgrounds in Hannover via an SDH (Synchronous Digital Hierarchy) transmission line. At this time the BALI network in Berlin (Berlin ATM LAN Interconnection) was connected to the ATM pilot network. At that point it already consisted of six ATM transmission platforms from three different manufacturers and some direct ATM workstations. At the fairground in Hannover a heterogeneous grouping of ATM products from various manufacturers in several exhibition halls was interconnected. The Berkom teleservices Multimedia Collaboration and Multimedia Mail were used as a demonstration application between Berlin and Hannover. The most important experience was certainly that it was necessary to reserve an ATM conection with a peak bit rate of approximately 60 Mbps in the long-distance traffic network for these applications, which require an average data rate of approximately 1 to 2 Mbps. This was because the transmitting workstations gave their data to the network unevenly, without smoothing. The testing functions at the entry to the long-distance network, however, measure the peak bit rate agreed on with the network nodes, which is calculated from the distance between consecutive cells, and discard all ATM cells which follow a previous cell sooner than agreed upon. This occurs in order to protect the long-distance network from short-term overload. As a consequence, arrangements were made with the manufacturers of ATM adapter cards to smooth the stream of ATM cells at the source and to avoid traffic spikes. This socalled Traffic Shaping is indispensible for stable operation of large ATM networks.

This was followed in the fall of 1994 by international ATM connections from Berlin to Japan, to the plenary session of the ITU in Kyoto, and by connections in the context of the pan-European ATM pilot experiments from Berlin to Madrid, Brussels, Paris, Oslo and Copenhagen, and also test connections to the U.S.

Problems and Solutions

These projects did not involve pure ATM tests; there was always a focus on the testing of new, usually multimedia services and applications. By now ATM has developed into a stable infrastructure for these applications-oriented projects. On the basis of these activities it was possible to gain a number of insights.

In addition to the problem of Traffic Shaping, which was not supported initially, it emerged in many tests that not all ATM components support the full range of values for the numbers of virtual ATM connections (Virtual Channel Identification/Virtual Path Identification, VCI/VPI). This means that there can be problems at times in the selection of the corresponding values which are used by two ATM setups which are to be connected with each other. The VCI and VPI values are necessary for unambiguous characterization of a virtual ATM connection. Normally an ATM device supports several thousand such connections simultaneously.

Particularly in the construction of larger networks, it is still a drawback that ATM transmissions and adapter cards do not support any signaling protocols for the formation and disassembling of ATM connections, or only support proprietary ones. This makes it necessary to arrange reserved connections via management functions. These management functions in turn are unfortunately still very diffferent from product to product, so that the configuration of an ATM connection over several nodes from different manufacturers can be very laborious. This will doubtless change during 1995, as soon as signaling protocols become available at the UNI and NNI interfaces (User Network Interface, Network Node Interface) which correspond to the specifications of the ATM forum.

Probably more relevant in the long run is the problem that at the moment there is no acknowledged transport system above the ATM protocol level which could make the new properties of an ATM network actually useful for applications, i.e., make them available as new network service qualities. The IP [Internet Protocol] protocol most used today can only meet the demands which result, for example, from the transmission of audio and video information in a very limited way. That is why various working groups are working on the design of new transport systems.

Another problem which results from the use of IP above ATM and already needs to be solved in an intermediate timeframe is the harmonization of the connectionless IP protocol with the connection-oriented ATM network. Although these problems also exist in a similar form in using IP in X-25 or ISDN networks, various solution strategies have been developed for each of these networks. In the ATM field we should mention the two mutually incompatible initiatives of the Internet Engineering Task Force (Classical IP) and the ATM Forum (LAN Emulation Service). As long as no stable, interoperative products are available, the copying of IP addresses to ATM addresses in large networks, for example, will have to be carried out through static tables, the upkeep of which is very tedious and error-prone in practice.

Development of ATM Services

On the basis of Internet transport services, it is of course possible to use all services in local ATM networks which are also common in IP networks, such as FTP (File Transfer Protocol), telnet or WWW (World Wide Web). In particular, the information and hypertext system WWW, which is distributed worldwide, becomes more and more attractive with the increased bandwidth; unfortunately, so far only a few WWW servers are accessible through broadband network connections.

Usually at least ATM Bearer Service is offered in public ATM long-distance networks, permitting a transparent transmission of random ATM cells. Telekom will also offer the connectionless Datex-M service and the emulation of constant-bit-rate connections with 2 Mbps (G.703/G.704). Practical testing of these services has just begun. For the German-French ATM network an additional frame-relay service via ATM is being planned.

In some projects which use the joint pan-European ATM network, the multimedia teleservices Multimedia Collaboriation and Multimedia Mail which were developed in Berkom projects are being used to investigate the advantages of ATM for such multimedia applications.

Opportunities and Risks

There is no doubt that entry into ATM technology still involves certain risks even for ambitious users. For example, the product cycle of the first ATM products is still very short, so that frequent software updates or exchange of hardware must be anticipated. On the other hand, early entry into this technology of the future provides experience and it has already been demonstrated in a brief period of time that it can provide advantages for network operation which will certainly be reflected in competitive advantages for the company.

In the long run it is probable that ATM will become established in local network markets and also in long-distance networks, even though the existing network technologies will continue to exist for many years alongside ATM. Realistic alternatives to ATM are nowhere in view at the moment. In laboratories the next step is already being worked on: the consistent introduction of ATM within an end system. The replacement of internal bus systems with a built-in ATM mini-transmission leads to a completely new end device architecture which permits a much more flexible design for PCs or workstations. Even today a workstation can often access a high-speed data server in the network more rapidly than its built-in hard disc. This will ienvitably lead to a shift of many components from the end system into dedicated network servers. The disintegration of end devices is already on the horizon.

[Box, p. 23]

The DFN ATM Project

The ATM project of the German Research Network is being implemented by the joint project partners DeTeBerkom, the Berlin Technical University and GMD-FOKUS, a research facility of the Society for Mathematics and Data Processing.

In the two-year pilot project funded by the BMFT [Federal Ministry for Research and Technology], the very heterogeneous ATM test environment built up in Berlin under the name of BALI (Berlin ATM LAN Interconnection) will be used; at the moment it includes 19 ATM transmittal systems from six different manufacturers. Some workstations from different manufacturers, a Cray supercomputer and traditional local networks like Ethernet and FDDI [Fiber Distributed Data Interface] are linked with this group. BALI is associated with the ATM pilot network of Deutsche Telekom and is currently linked with ATM networks in other countries. Among other things, it will be used to test out new multimedia teleservices. These are services which will make it possible to use videoconferencing in every workplace and to work on documents together or send multimedia messages.

Knowledge gained with the new transfer technology will benefit the planned set-up and operation of a scientific network in Germany based on ATM. The ATM system technology is being investigated in this project especially with reference to its interoperability properties, the linkage of ATM end devices to local networks and the integration of traditional LAN technologies (Ethernet, FDDI, etc.) and long-distance traffic networks (IP, X-25, ISDN, etc.) into ATM networks.

By the middle of 1995 the three BALI partners will have ATM test centers, which can also be used by interested industrial partners. In addition, an ATM management center is currently being set up. Further information about the project can be accessed via the World Wide Web service on the Internet: http://www.fokus.gmd.de/nthp/dfn-atm.

Germany: Growth of ISDN Networks Expected on Information Superhighway

95WS0271C Munich COMPUTERWOCHE in German 3 Mar 95 p 25

[Article: "ISDN: from Wallflower to Highly Traveled Information Highway"; subhead: "Telekom Launches Promotional Program for Small Business and Individual Customers"]

[FBIS Translated Text] **Bonn/Hannover—For a long time Telekom had to endure scorn and derision for its domestic prestige object, ISDN [Integrated Services Digital Network]. Admittedly, this is different now: once on the verge of going belly-up, it has given rise to the information highway that is finding more and more customers and that has even become pan-European on the coattails of Euro-ISDN. Cheaper and more available than ever, therefore, is the jingle associated with ISDN, bolstered by a new promotional program.**

In actuality the digital network of the former Bonn-based postal outfit was neither fish nor fowl in the view of many experts: for some it was a quasi deluxe telephone system not suited for data transmission, for others it was simply unnecessary and too expensive. On top of this there were strategic errors in market introduction, or, as many contemporaries now put it, quite simply there were no applications.

But in an era of video and PC [personal computer] conferencing the applications missing to date are suddenly there requiring [and paying for] bandwidths of 64

Kbits/s [kilobits/second] and up. Now, according to a deliberately worded CeBIT explanation by the carrier from Bonn: "The soaring demand for ISDN connections has far exceeded original projections. At present, with nearly two million B-channels sold, Deutsche Telekom indisputably is assuming the top position globally." Three weeks ago, Gerd Tenzer, Telekom managing director for technical systems, already had addressed ISDN's strategic significance: "We are vigorously expanding this information highway nationwide and we are being envied for it even in the U.S., homeland of the information highway."

Now, it need not be envy, but even in the New World, for a rather long while already, something like an ISDN renaissance has begun to surface—precisely or primarily because even there after all the information highway euphoria, the quest is on for affordable bandwidth. But back to ISDN global (market) leader Telekom: by the end of 1994 alone the number of basic connections (each having two B-channels) increased to more than 500,000 and primary multiplex connections (each having 30 B-channels) to more than 27,500. Simultaneously, according to Telekom, since May 1994, the Euro-ISDN, introduced in December 1993, is generally available wherever a domestic ISDN connection is provided. Germany, therefore, at least in the European context, unequivocally leads France in holding the top position.

So that in the future Europe's information highway will be increasingly frequented even by midsize and small cars, at CeBIT, Telekom announced a new ISDN promotional program, purportedly for small business and individual customers. All customers newly acquiring a local end ISDN for connecting Euro-ISDN multi-equipment connections and simultaneously contracting for a Euro-ISDN multi-equipment connection between 8 March 1995 and 31 March 1996 will receive a one-time credit on their telephone account.

For each newly acquired local end ISDN the allowance amounts to 300 marks [DM]. Telecommunications systems that can be connected to multi-equipment connections are given a DM700 allowance. Telekom expects a further sales boom of ISDN basic connections from this promotional activity. The latest projections, according to the folks at Telekom, are premised on 1.5 million by the end of 1996. In any event, by CeBIT '96 the team from Bonn wants to realize a sales target of one million ISDN basic connections.

Germany: Deutsche Telekom, Siemens Nixdorf Cooperate in Multimedia Market

95WS0271D Munich COMPUTERWOCHE in German 3 Mar 95 p 26

[Article: "Telekom and SNI Tie Up Shared Multimedia Package"; subhead: "SAP Is Proshare Customer"]

[FBIS Translated Text] **Hannover—Deutsche Telekom AG [rporated] and Siemens-Nixdorf Information Systems AG (SNI) are actively cooperating on the multimedia market. At CeBIT the partners presented the first result of their cooperation in the form of a PC [personal computer] model that integrates Intel's "Proshare" video conferencing platform.**

Horst Gellert, member of the carrier's board, described the product as a plug-and-play device desired by the customer. Add-on components like CD-ROM [compact-disk read-only memory] drive, sound board, speakers and a LAN [Local-Area Network] board convert SNI's Pentium PC into a multimedia computer.

Telekom's contribution to the joint product is Intel's Proshare for the marketing of which the carrier is responsible. The pact between the two large German firms, however, is not limited to the design of soft- or hardware solutions. Telekom and SNI jointly want to develop PC-based multimedia communications. Hence, for instance, LAN and ISDN components are customer and branch customized, and individualized services are offered to end users.

SAP AG is one of the first customers of Telekom-SNI's offer. The German software business uses the system in connection with ISDN connections to shorten internal and external decision-making processes. As a visual workstation, Proshare is also a communications alternative for tax offices. At the data processing organization [DATEV] Proshare is to improve the information flow of tax consultants with one another and with their clients. Among other things, the concept includes contact points for colleagues who have specialized in specific subject areas.

The multimedia package presented at the fair costs about 4,200 marks [DM]. As a CeBIT sale, Telekom is posting a DM1,200 credit for an equipment purchase coupled with an ISDN connection. The special price is good until 31 March, until the end of September 800 will continue to be knocked off.

Germany: Telecommunications Market Expected to Reach 115 Billion Marks by Year 2000

95WS0263A Munich COMPUTERWOCHE in German 10 Mar 95, Extra No 2, pp 4-7

[Article by Angelika Schrader[1]: "Telecommunications in Germany: Diversity, Competition, Visions"]

[FBIS Translated Text] **The figure is 115 billion marks [DM]: such is the amount that the telecommunications market Germany will allegedly be worth in the year 2000 according to market researchers. It is obvious who is going to pocket the lion's share: despite increasing competition and alluring new offers from other market participants, Telekom will not so quickly be toppled from its position as market leader. Still, the competition is marshaling itself and jolting the team from Bonn with constantly new alliances and strategies.**

[Boxed item]

Abstract

Virtually on a weekly basis there are swarms of fresh reports of alliances entered into with telecommunication giants by large firms from all branches. Cash and know-how combine to undertake even now the preliminary actions as many market shares as possible in the telecommunications market. The desire is to be prepared in 1998 if Deutsche Telekom AG [Incorporated] network and telephone service monopoly topples. Fresh products and services are in development and the tough competition in any event will have a positive customer impact.

Various firms are engaged in the telecommunications market: for instance, so-called carriers like AT&T or BT British Telecom, that possess their own global wiring systems and offer telephone and data transmission services on them. Since the onset of regulation those firms have been represented even in Germany by branch offices, but here they have to lease the system of monopolist Telekom, (so far still) the sole German "carrier." Both Telekom and its rivals offer the most diverse value-added network services (VAN) on the copper and glass fiber cabling that stretches over untold thousands of kilometers throughout Germany. These may entail simply fax or e-mail services or database services but also corporate networks wherein the VAN supplier undertakes the voice and data transmission service among the diverse sites of client firms. Even data transmission involving the X.25 protocol that Telekom supplies with the Datex-P service or the Datex-J screen text service comprises VANs. All suppliers of telecommunications services in Germany—currently, in excess of 500—require a permit from the Federal Ministry for Post and Telecommunications (BMPT) which twice a year publishes the names and services of registered suppliers in its official gazette. In Germany the major market participant remains Deutsche Telekom AG. At the start of the current year Telekom undertook one of the most significant steps in its corporate history. On 1 January 1995 its transformation into a corporation was complete and stock market entry is projected for the coming year. Deutsche Bank, Dresdner Bank and the U.S. investment bank of Goldman Sachs are heading up a broad consortium of 22 banks altogether to put Deutsche Telekom AG on domestic and international stock markets in 1996 in the framework of a capital increase.

The firm will use the proceeds from the shares mission to enhance its domestic and global competitiveness, to embark on further cooperations and to be able to consolidate its regional commitments abroad—not even to mention its heavy debt burden. What does the business customer get out of this? He profits from the competitive pressure, the responsibility of the former Bonn anti-monopoly authority. Prices will tumble, the diversity of offerings in the area of corporate networks, voice and data VANs will increase (chart 1) and activities that Telekom has undertaken to improve customer care will be proceeding apace. New sales employees and service technicians are being recruited from virtually all branches and existing Telekom employees are being trained on a broader level to make the quantum leap from government to a market economy oriented company. On top of this there will be comprehensive "Total Quality Management" (TQM) measures that are supposed to elevate and maintain Telekom on a global level in terms of the quality of its products and services. The only good customers are loyal customers and there is a genuinely real risk that qualified competitors of Telekom will lure its customers away not only in the data services segment but in two or three years also in the profitable telephone service (chart 2).

The Competition Is Not Sleeping

Following postal reform in 1989 under the auspices of then minister, Dr. Christian Schwarz-Schilling, that first split Germany's federal post office into the three companies for telecommunications, postal service and postal banking, structural changes ensued in quick succession with immediate customer benefits. Monopoly offerings like data services or mobile radio were opened to competition and with the establishment of rival outfits like Meganet GmbH [Limited] and Info AG, that were among Telekom's first rivals in the late eighties in the data services segment, there was a sharp drop in prices that is still not large enough for most customers in terms of the increasingly lower tariffs for high-speed data transmissions in other countries.

The network monopoly and telephone service monopoly currently still persist and, with a reprieve until 1 January 1998, guarantee revenue for Telekom. On the basis of Telekom's monopoly leased lines a whole bunch of companies supply voice and data VANs. Since July 1990, the suppliers of telecommunications services registering in accordance with the law on telecommunication systems with the BMPT are published semiannually in the official gazette. Since then, several hundred suppliers have been registered there with services ranging from simple fax service to network outsourcing and corporate networks. All of them are both competitors and customers of Telekom, since their offerings are obliged to occupy Telekom's monopoly lines.

That will soon change: full attention is riveted on 1 January 1998. The EU Council has unanimously adopted a resolution on liberalization of the telecommunications infrastructures in EU countries. Under its terms there is no longer to be any telephone service or network monopoly even in Germany. It has loudly signaled the time for the arrival of the suppliers of alternative infrastructures: system infrastructure owners include the German Railways Inc., utility companies and municipalities as well as Telekom. Still, it is not merely the utilities but also the large mixed companies in Germany that are jumping on to the train in a big way. VEBA AG [Amalgamated Power and Mining Operations] has consolidated its telecommunications activities—carefully prepared through small participations and acquisitions—into Vebacom, RWE Energy AG

[Rhine-Westphalian Electric Works] has recently combined its communications expertise in RWE Unitel AG, and in December even steel giant Thyssen set up a Thyssen Telecom AG. It is the assumption of the experts, however, that, considering the available alternative infrastructures, the possibility for earning big money will not be in the basic infrastructure but instead in the products and services riding on it. Anyone, therefore, wanting to guarantee himself an absolute competitive edge with a 4,000- or 5,000-kilometer-long glass fiber system has left the service suppliers out of the picture. For even at present the system monopoly and the telephone service monopoly are separated from one another and competition is rife in mobile radio and in data services. And even though Telekom's rivals have no infrastructure of their own they are garnering sizable sales and profits. If even in the future the BMPT awards separate licenses for infrastructure and services, suppliers with infrastructure will not have any noteworthy strategic competitive edge.

"We" Are Strong Only Jointly

Fixed system or wireless system infrastructure, it makes no difference: all market participants have recognized that only with financially powerful and technologically experienced partners can they apply the enormous investments and comprehensive know-how for the integrated communications market. The sorts of modern communications infrastructures currently utilized in corporations consist of a combination of integrated voice and data applications and make use of fixed systems as well as satellites and mobile radio links and increasingly include broadband applications and, in a foreseeable period, will also include cable TV. Add to this the terminal business in which more and more carriers are getting involved. So-called vertical integration, meaning services and terminals available from a single source, is convenient for customers, and for the supplier it is a welcome means of customer-bonding.

Market speculation is fueled by any report of fresh mergers. How many suppliers will it cope with? How many suppliers will share the cake of more than DM115 billion (chart 3)? Will Deutsche Telekom AG manage to hold on to a 70-percent share? In any event that is what its British counterpart succeeded in doing. Back in 1984, British Telecom was converted into a corporation under the iron hand of Margaret Thatcher and while it has, in fact, lost market share, it still grew to be the world's fifth largest telecommunications supplier and is earning greater profits and performing more productively than in its time as a monopoly.

Joint Venture Between BT and VIAG

Only at the start of this were there headlines about the latest merger that has now also paired the last of the "global players" with a German firm. VIAG AG [United Industrial Enterprises Company] and BT British Telecommunications plc. are setting up a joint venture company to develop a countrywide telecommunications network in Germany. It must have been with complete amazement that the world of experts joined in mulling the fact that VIAG AG, an unknown quantity in terms of telecommunications, was able to induce the internationally renowned telecommunications giant almost entirely to squelch its name recognition in Germany. The projection of Munich's experts on following currents is: if BT's name can appear as little as possible, the prospects will increase for getting from BMPT the coveted licenses for fixed system and telephone service, as a "German" company. VIAG AG's managers seem to have overlooked the fact that the image and experience of the highly successful and globally active BT (chart 4) could be assessed extremely favorably, not least even among potential telecommunications customers. Hence the firm that makes a turnover of nearly DM40 billion in the energy, chemical, packaging and logistics sectors, wants to merge even the activities of BT Germany GmbH, Eschborn, in the recently established VIAG InterKom (headquartered in Munich).

Deutsche Telekom AG Relies on International Partners

BT's global business will remain unaffected by the deal. Together with the second largest U.S. carrier, MCI, in which BT has a 20-percent share, under the "Concert" label the British firm provides sole source services and products. The VIAG InterKom joint venture has unrestricted access to those resources and to BT's international know-how.

Deutsche Telekom AG also relies on international partners. For a long time now the group from Bonn has been teamed up with French neighbor France Telecom and established various joint subsidiary companies. For instance, each of the two has 50-percent shares in the VAN provider Eucom, Saarbruecken, as well as in the Eunetcom firm (Paris, Frankfurt) specializing in outsourcing and the operation of private networks in the international arena. The latest offshoot of the German-French liaison bears the operational name Atlas and still has to prove its existence is justified. The artificial divisions of target groups and available products and services of the individual German and French joint ventures are mind-boggling. On top of them are the activities of Telekom's overseas subsidiaries plus the recently established TIS Telekom International Sales Division. And, last but not least, in Infonet Deutschland GmbH, Deutsche Telekom AG has a subsidiary (80 percent) that provides services to local telecommunications companies worldwide as a partner in cooperation and supplementary to domestic services and in doing so has specialized in data VANs. Infonet Services Corporation, a joint venture comprising 10 large telecommunications corporations from around the world, holds the other 20 percent of Frankfurt-based Infonet.

While British Telecom has chosen U.S. carrier MCI as an international partner and Europe's Unisource (a joint

venture of Dutch, Swedish, Swiss and Spanish telecommunications firms) has allied itself with AT&T, Deutsche Telekom and its France Telecom partner opted for an alliance with the remaining third U.S. carrier, Sprint. But the Phoenix joint venture that is supposed to emerge from this alliance is arousing the displeasure of U.S. and European custodians of competitiveness. AT&T in particular has lodged an objection with the U.S. agency overseeing competitiveness, the FCC [Federal Communications Commission] to the effect that U.S. rival Sprint, as a result of the joint venture with the Germans and the French, will have access to quasi-monopolistic markets in Europe from which the other carriers are barred.

It remains to be seen how competitors will view the telecommunications market in Germany. The premise of the experts is that essentially three market participants will share the large cake among themselves: first, Deutsche Telekom AG plus its subsidiaries and partner firms; second, the VEBA company and its diverse participations and activities comprised in Vebacom. The third candidate to be take seriously for a rather large slice is, furthermore, Communications Network International GmbH (CNI) that had been set up back in 1993 as "German Society for Network Services (DGN)," in the form of a joint venture by Mannesmann Eurokom (50 percent), Deutsche Bank (25 percent) and RWE AG (25 percent). After the reengineering, CNI describes itself as the "corporate network-arm" under RWE's large umbrella. Deutsche Bank's participation in the society has resulted in a rather precarious situation that the monetary institution, meantime, has made to appear somewhat more mitigated in network groups: the bank is hardly able to earn big money by issuing Telekom shares and simultaneously woo customers as rivals of Telekom. CNI wants to lure new customers—Deutsche Bank's 1,600 branches already use the services of the outfit from Frankfurt—with modern ATM [Asynchronous Transfer Mode] technology. By mid-1995 Siemens and Northern Telecom will develop a new ATM backbone network for the company. Siemens will assume responsibility as leader of the consortium for the voice routing, ISDN [Integrated Services Digital Network] and "Intelligent Network" (computer-controlled routing technology on the system) in the DM33 million project, while Northern Telecom, in turn, will supply the technology for data routing and ATM broadband switching.

CNI has also begun a search for cooperation and—pending approval by the appropriate anti-monopoly authorities—on 1 January of this year took control of 60 percent of Eunet Deutschland GmbH's common stock. The current partners, the Society for VANs in Telecommunications (GMwD), Bonn, and the German Unix Users Group e.V. (GUUG), Erlangen, still each have 30 percent and 10 percent shares, respectively. The aim of the cooperation is jointly to develop an improved position on the market for telecommunications VANs in Germany. As one of the largest German Internet service providers and member of a European-wide alliance of firms providing VANs under the Eunet label, Eunet therefore brings along precisely the right dowry to the marriage.

Diversity Creates Market Shares

In terms of telecommunications, RWE Energy AG mostly goes its own way: comparable to Vebacom, the utility company has set up RWE Unitel AG, an executive holding company, to assume all participations in the telecommunications market as a 100-percent subsidiary of RWE Energy. The basis of RWE's activities is a proprietary telecommunications system plus decades of experience in operating that system for telephone, data and signals transmissions (remote control, for instance). Some years ago, in fact, RWE began installing glass fiber lines and digital point-to-point radio. According to the firm the tele-line system covers nearly 40 percent of Germany's surface area and 50 percent of the major firms' client profile. RWE has a 43-percent share in the Society for Wireless Data (GfD) that received a license for wireless data in 1994. Mannesmann Eurokom, Deutsche Bank, France's Cofira as well as RAM Mobile Data Network GmbH, a German subsidiary of Bell South Corporation, hold additional shares.

Telephone Service Remains the "Cash Cow"

In October 1994, RWE Energy AG scored a major strategic coup with the takeover of Mobilfunk GmbH from Preussag AG. Preussag Mobilfunk GmbH lumps together all of the Preussag firm's telecommunications services, (excluding terminals, that remain with Preussag's Hagenuk group). Mobilfunk GmbH comprises the three segments Talkline (10 percent), Miniruf (40 percent) and Teleport Europe (50 percent). In this way RWE has available not only a proprietary fixed system infrastructure but, via CNI, an available corporate network, and, via Mobilfunk GmbH, mobile telephone services plus a domestic wireless pager system and satellite transmission capabilities for voice, data and video services.

This acquisition, in fact, has yielded an attractive competitive structure, since major rival Vebacom likewise holds shares at this point in Miniruf GmbH that, in July 1994, received from BMPT a license to develop and operate a domestic wireless pager system, and in Teleport Europe, Hannover. In a short period of merely two years, VEBA AG has bought up a full-blown telecommunications empire that will square off on the German market as a serious contender to Deutsche Telekom. Vebacom comprises a complete infrastructure and product palettes from satellite, mobile radio and pager systems as well as data, voice, cable TV and broadband systems. Vebacom GmbH's announcement that it will operate telecommunications activities in the future jointly with German Railways AG in some areas must have dealt a blow to many a rival. The mixed corporation's prospects for a large piece of the cake worth billions also will increase as a result of various participations abroad. Vebacom, for example, has a 15-percent

share in the Bouygues Telecom consortium that has lined up on the starting line as the third operator in the mobile radio market.

What Vebacom still needs is a large international partner. Because of its joint venture with Unisource, AT&T is no longer available and even other majors like BT or other U.S. carriers are already spoken for. As regards the allocation of the German market, it is hard to assume that, besides Deutsche Telekom and its partners, RWE Unitel together with CNI and Vebacom, other consortiums will have large opportunities in the domestic market. The recent joint venture between VIAG and British Telecom has to first position itself on the market as a Bavarian-British firm. Issuance of the second telephone service license is especially tantalizing, since it signifies the prospect of big money. As one of the competitors worded it not too long ago: "Compared with revenue from voice service, data service earnings are at best penny-ante." One thing is sure, we are facing three extremely suspenseful years in this market, as the projections for the telecommunications until the year 2003 confirm (chart 5).

Footnotes:

1. A. Schrader is a journalist in Munich who has also researched the telecommunications market in various consulting projects.
2. All of the chart material was kindly made available to us by DATACOM Publisher GmbH.

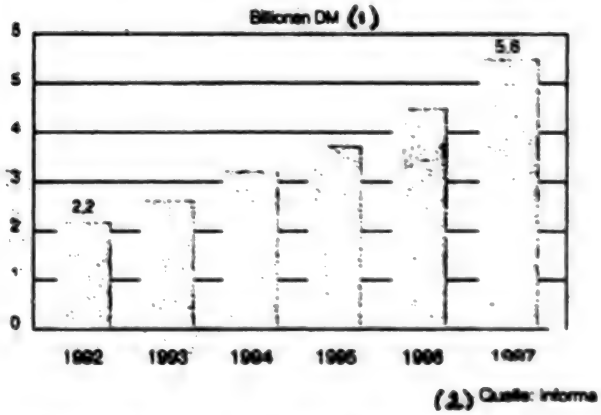


Chart 1: The Market for VAN Services 1992-1997[2]

Key: 1. Billions of DM; 2. Source: Informa

		Mrd. DM (7)	Prozent (8)
(1)	Telefon (davon ISDN)	42,8 (2,5)	72 (4)
(2)	Endgeräte, Service, Öffentliche Telefone	5,4	9
(3)	Datenkommunikation	4,8	8
(4)	Breitbandkabel, Rundfunk	3,2	5
(5)	Mobilfunk (inkl. DeTeMobil)	2,6	4
(6)	übrige	0,6	2

Chart 2: Telekom's Sales Structure (1993) Reveals Telephony's High Share[3]

Key: 1. Telephone (including ISDN); 2. Terminals, service, public telephones; 3. Data communications; 4. Broadband cable, radio; 5. Mobile radio (including DeTeMobil); 6. Other; 7. Billions of DM; 8. Percent

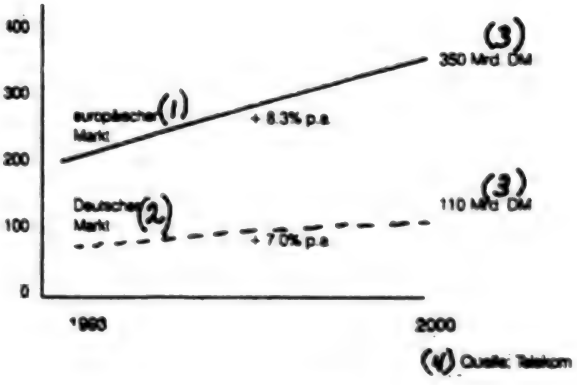


Chart 3: Growth of European and German Telecommunications Markets[4]

Key: 1. European market; 2. German market; 3. Billion DM; 4. Source: Telekom

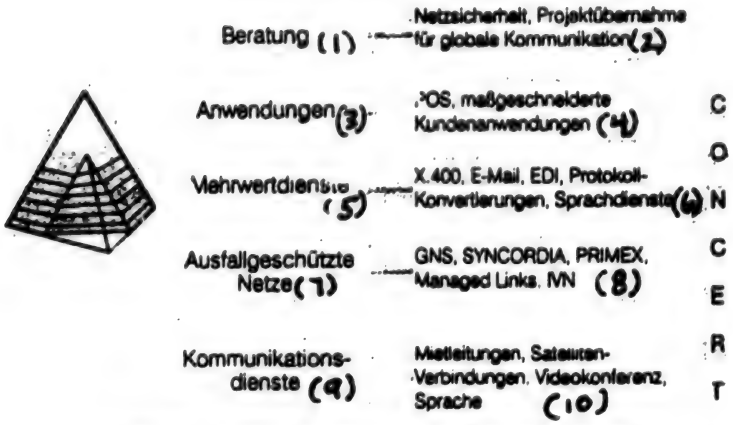


Chart 4: British Telecom's Global Product Strategy[3]

Key: 1. Consulting; 2. Network security, project responsibility for global communication; 3. Applications; 4. POS, customized client applications; 5. VANs; 6. X.400, e-mail, EDI [Electronic Data Interchange], protocol conversions, voice services; 7. Networks shielded from failure; 8. GNS, SYNCORDIA, PRIMEX], managed links, IVN; 9. Communication services; 10. Leased lines, satellite links, video conferencing, voice

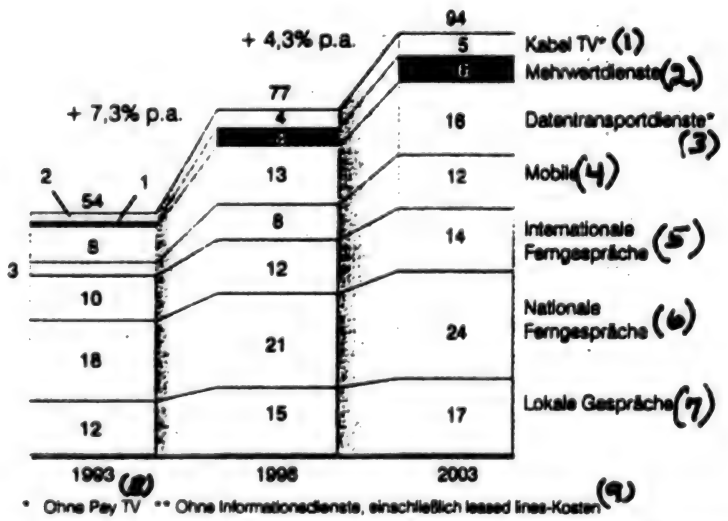


Chart 5. Growth of the Telecommunications Market in Germany by 2003, According to Vebacom[3]

1. Cable TV; 2. VANs; 3. Data transport services; 4. Mobile; 5. International telephone calls; 6. Domestic telephone calls; 7. Local calls; 8. Excluding pay TV; 9. Excluding information services, including leased-lines costs

Bavaria Plans High-Speed Data Networks

95WS0291B Frankfurt/Main FRANKFURTER ALLGEMEINE in German 22 Mar 95 p 5

[Article by "Fin": "'Bavaria Online.' The Free State Is Planning High-Speed Data Networks"]

[FBIS Translated Text] Munich, 21 Mar—The state government of Bavaria has decided to construct high-speed data networks in the free state. Business and industry first of all are to get the most up-to-date information capabilities with this. But among the 16 pilot projects is also a "Bavarian Health Network," that is to enable the exchange of information between clinics, private physicians and medical information services. Besides, the intention is to connect into a network the universities, technical institutes and non-university research institutes. The exchange of information between the Bavarian authorities is also one day to take place at split-second speed. In addition, a "Bavarian Network" will be installed, in which smaller companies

and even individual private households will be able to participate. The schools are to be connected to one part of the network, in order for students to learn to use such systems.

With these preparations Bavaria regards itself to be technologically in the lead of all the federal states. While other German cabinets, Minister-President Stoiber remarked, still barely have enough money to fulfill their obligations under the law, Bavaria is able after the sale of industrial holdings to afford to provide for an especially high standard in communications technology, which is becoming ever more important. The free state is shouldering 100 million of the 300 million German marks [DM] that the Bavaria Online plan is to cost. The predominant share will be financed by industry, which, after 1998, when the Telekom [German Postal Service's telecommunications branch] monopoly ceases to exist, will be in a position to design and offer its own systems. Infrastructure quotations at internationally competitive prices cannot be expected till then, Stoiber said, whereas the present German system is 10 times as expensive as that of the United States. The minister-president justified this kind of meddling by the government in the affairs of industry with the reflection that the time for "learning" has to begin now, but the construction of networks is very expensive. Munich Professor Ingolf Ruge, the head of the Fraunhofer Institute for Solid-State Technology, is technical head of the project.

Canada-Germany: DASA Cooperates with Orion Atlantic in Satellite Communications

95WS0271A Munich COMPUTERWOCHE in German 3 Mar 95 p 4

[Article: "DASA AG and Northern Telecom Establish Nortel DASA GmbH"; subhead: "Joint Venture to Provide Telecommunications Products and Services to Network Operators"]

[FBIS Translated Text] **Hannover—Daimler subsidiary Daimler Benz Aerospace AG [Incorporated] is intensifying its commitment in the telecommunications area. Shortly after DASA [German Aerospace Agency] embarked on cooperation with Orion Atlantic in the satellite communications sector, DASA managing director Werner Heinzmann has now announced at CeBIT the aerospace outfit's latest joint venture: jointly with Canada's Northern Telecom Ltd., the team from Swabia desires to set up Nortel DASA Network Systems GmbH [Limited] & Co. KG [limited partnership].**

Northern Telecom has a 50-percent share in the new joint venture that is to be launched in April in Friedrichshafen while DASA has signed on for 40 percent and Dornier GmbH for 10 percent. The joint venture, endowed with 40 million marks [DM] in initial capital, wants to provide network operators with products and services for telecommunications systems. The folk from Swabia hope in this way to be able to capitalize on existing resources and technologies for growth in the civilian sector focused on communications following the definitive downturn in defense business.

In this context, starting out with a labor force of 600 employees, the joint venture's product palette is to include networks and network management systems, technologies for multimedia applications, communications systems for the business world, LANs [Local Area Networks] and MANs [Metropolitan Area Networks] plus satellite communications. In Heinzmann's words, Nortel DASA, however, will not be a network operator but only a network provider. Hence, according to the managing director once more, the new establishment will not compete with private network operators such as Vebacom or Cable & Wireless. Instead, it is precisely in the private sector providers that the manager sees future customers.

The range of offerings is to be developed with the assistance of a new technology center in Friedrichshafen. Over the upcoming five years DASA plans to invest DM300 million in it.

France: Saint-Gobain to Buy BP's American Carborundum

95WS0268A Paris L'USINE NOUVELLE in French 16 Feb 95 p 30

[Article by Pierre Laperrousaz: "Saint-Gobain Reaffirms Commitment to Ceramics"—first paragraph is L'USINE NOUVELLE introduction]

[FBIS Translated Text] **After several years of austerity, the group headed by Jean-Louis Beffa is resuming its acquisition policy. Its first target: Carborundum, a US company...**

Saint-Gobain is further entrenching itself as a ceramics maker. The group has just announced that a decision has been made to enter negotiations with a view to acquiring Carborundum, BP's American subsidiary. For Saint-Gobain, the accord would mean adding 1.3 billion French francs [Fr] to the current annual turnover (about Fr6-7 billion) of its industrial ceramics division.

With its acquisition of Norton in 1990, the French firm had already become one of the world's biggest producers of silicon carbide. The takeover of Carborundum, which transforms materials rather than creates them, should further strengthen its position. Silicon carbide is an extremely hard material, highly resistant to wear and tear, corrosion, and thermal shock; it is used in fabrication of bearings, nozzles, heat exchangers, etc., and is one of the few ceramic technologies to make a niche for itself in the automotive industry. In 1989, for example, Carborundum invested $7 million in a pump gasket fittings production unit in Monchengladbach, Germany. Its principal client is Volkswagen.

But the potential applications of silicon carbide are not limited to mechanics and thermology. In recent years, Carborundum has invested heavily in microelectronics research. Silicon carbide and aluminum nitride make excellent substrates for microelectronic circuits. Compared to silicon and aluminum, they support higher temperatures and operate at much higher frequencies and voltages. Among those interested in these performance characteristics are the military. This development potential in the electronics field is probably also of interest to Saint-Gobain, which already has one foot in the door thanks to the products manufactured by Germany's Stettner, which it acquired in 1988. Norton for its part brought to the group a technique for making thin diamond coatings, which among other things might have uses in the microelectronic substrates market. More than ever, with the acquisition of Carborundum Saint-Gobain will be a world leader in the field of "black" products (silicon carbide and silicon nitride). But it is also a leading producer of "white" products—a position which it strengthened in 1991 with the purchase of Ceramiques Techniques Desmarquet, a company specializing in aluminum and zircon based products such as liquid spray diffusers for agriculture, hip prostheses, and pump gaskets for automobiles.

The activities of Carborundum and Saint-Gobain also dovetail in the domain of refractory materials for furnaces, a specialty of SEPR, one of the companies in the French group. The product lines of the two companies should mesh together nicely, with the American company and SEPR both offering silicon-carbide based products and electrofused zircon-aluminum and silicon-aluminum refractories. SEPR had already reinforced its position in the latter domain with its 1988 acquisition of the U.S. company Corhart Refractories.

Beyond Europe

The negotiations with Carborundum do not cover the North American firm's ceramic fiber manufactures, "which present no synergies with Saint-Gobain's activities in this area." The French group has already made a commitment in this sector with its 1986 takeover of Kerlane, a French company. Kerlane fabricates silicon-aluminum-zircon based fibers that can withstand temperatures of 1,450°C. and are used for insulating furnaces used in steelmaking, the oil industry, the ceramic industry, etc. Carborundum makes similar products at its Rainford plant, in Great Britain.

Beyond broadening and strengthening its product line, the acquisition of Carborundum, if it materializes, would help Saint-Gobain increase its presence in Latin America and North America and establish itself more definitively in the Asia-Pacific zone.

Saint-Gobain, Carborundum Product Lines

Products	Saint-Gobain	Carborundum
Silicon carbide: abrasives, mechanical and thermal parts, electronic substrates	Yes	Yes
Silicon nitride: mechanical parts	Yes	Yes
Aluminum, zircon: mechanical parts, prostheses, plasma deposition	Yes	No
Fibers (aluminum, zircon, silicon): furnace insulation	Yes	Yes
Electrofused refractories (aluminum, zircon, silicon, magnesium): furnaces	Yes	Yes
Technical crystals: optical, laser, instrumentation	Yes	No
Aluminum nitride: electronic substrates	No	Yes

Source: L'USINE NOUVELLE

Franco-Italian GIE, British Aerospace Merge RTP Project

95WS0272A Paris L'USINE NOUVELLE in French 2 Feb 95 p 26

[Article by Odile Esposito: "ATR Condemned to Alliances"]

[FBIS Translated Text] **Through its partnership with British Aerospace, the Franco-Italian GIE [economic interest group] has salvaged its market, industrial plant, and profitability. But it must probably move quickly to find additional partners...**

After months of discussions, the Franco-Italian consortium ATR has found the right partner. British Aerospace has agreed to merge its "regional air transport" activities—including those of its two subsidiaries Jetstream and Avro—into the GIE now consisting of Aerospatiale [French] and Alenia [Italian]. Ownership of the new "mini-Airbus" will be divided equally among the three partners. At first the partnership will cover only sales and after-sales service, but the move is expected to lead rapidly to an industrial restructuring, and more specifically to a division of labor between the three countries. The only certainty at this point is that British Aerospace is ending fabrication of the Jetstream 61, its 70-seat turbojet that is a rival of the ATR 72. A decision that dooms the Scottish installation where that aircraft is assembled.

For British Aerospace, which has been losing more than 160 million pounds per year on its manufactures, the alliance was vital. But it is even more crucial for ATR. Granted, the GIE in 1994 posted an operating profit for the fourth consecutive year—on the order of 40 million French francs [Fr] on Fr3.8 billion turnover. But even so, the profit picture for 1995 looks tenuous. "The accident last 31 October in Indiana hurt us," admits Henri-Paul Puel, the consortium's general manager. Battered by a run of bad luck—three accidents in six months (in Morocco, the United States, and Taiwan early this week)—ATR has had only six orders in the last three months.

And with buyers in no hurry to take possession, ATR may deliver only 25 units in 1995. A financially dangerous situation, since the GIE is bringing in revenue at the rate of only four planes per month. For the moment, Puel is maintaining this pace of production (4 units per month, versus 4.4 in 1994). But if clients postpone taking delivery, he may have to slow down. Unless the shutdown of its British competitor's production line stimulates ATR 72 sales.

"Here in Europe, we just couldn't continue with four or five builders," admits Puel. The arrival of British Aerospace has the virtue of clarifying the situation and rationalizing product lines. In addition, it gives the GIE a new market niche: Avro's 70-115-seat jets, which travel faster and farther than turboprops. But will this alliance be enough for the long term? The regional transport market is showing good growth, but competition between ATR, Fokker (allied with DASA [German Aerospace]), and Saab is intense... What's more, airlines are not exactly falling all over themselves to modernize their fleets. Most of all, the airplane builders must reckon with the imminent arrival of new Asiatic competitors on the market.

Laboring under all these constraints, the new GIE is not likely to remain a trio for long. Who else will it bring in? DASA "is continuing its discussions with ATR and British Aerospace." But nothing can be ruled out. Not even an opening to an Asiatic partner. The restructuring of the regional air transport market is just beginning.

[box, p 26]

Expensive Testing

To clear the ATR 72 of all suspicion following the American Eagle crash, ATR carried out a whole series of tests between 19 and 23 December at California's Edwards [U.S. Air Force] Base. The object of the testing was to document the behavior of the aircraft while flying in a particularly rare and dangerous type of icy fog composed of big droplets 200 microns in diameter (versus the 40-50 microns specified in aeronautical certifications worldwide for typical icy conditions). To do this, a U.S. Air Force tanker was equipped with a special nozzle designed to spray this type of fog over the ATR in-flight over a 20-minute period. According to Gilbert Defer, the test pilot in charge of the exercise, "The tests showed it was possible to obtain ice deposits exceeding the capacity of the pneumatic de-icers." These deposits can weigh between 5 and 20 kilograms. But in every instance, even when the wing was completely covered with ice, "the pilot can maintain course and attitude despite the swerving of flight controls due to icing." Following these tests, the U.S. Government demanded modifications to the pneumatic de-icers, tube-like contrivances that break the ice by inflating. The cost: $13,000 for each ATR 42, twice that amount for each ATR 72. For the entire ATR fleet, $8 million. The GIE estimates the testing alone cost it more than $1 million.[end box]

Germany: AEG, Schneider Automation Merge Robotics Divisions

95WS0272B Paris L'USINE NOUVELLE in French 2 Feb 95 p 20

[Article: "AEG and Schneider Join Product Lines"]

[FBIS Translated Text] **Last October the robotics divisions of AEG and Schneider were merged. Here's a first look at how the new partnership has performed...**

Cegelec's acquisition of AEG's industrial control division recalls to mind another alliance, one which was announced last April and went into effect in October: the merger of the robotics divisions of AEG and Schneider into AEG Schneider Automation (ASA).

With the notable difference that AEG did not cede automation control to its partner Schneider. Even though from inside ASA it looks like Schneider is in the driver's seat—the president must be French, and marketing is done mainly through the Schneider distribution network—ASA is owned in equal shares by Schneider and AEG. "The robotics activity is very strategic for our other areas of concentration," comments Wolfgang Dorflinger, a member of AEG's steering committee and the ASA oversight committee.

"Thanks to synergies in terms of product lines and facilities, we are expecting 5 to 10 percent growth this year, in other words higher than the market as a whole," is the initial assessment of Bernard Quancard, sales and marketing director for ASA. He too is expecting this marriage to bring a rapid return to profitability.

But the problem of future product lines is more immediate for ASA than for the Cegelec-AEG duo. "Within the next two years we will offer a common platform for equipment, software, and networks. Migration utilities will assure compatibility with existing applications," says Quancard.

In the meantime, as Dorflinger points out, the problem for ASA is to limit the risks inherent in any merger: "Such operations always excite anxiety among the users," he admits. Thus Quancard takes pains to emphasize that the merger will not mean the end of the April or Telemecanique product lines. "We invested heavily in further expansion of these lines in 1994, and that effort will continue this year," he assures. One must add that the group—and its clients—have a fair amount of experience in this area: Recent years have witnessed successively the convergence of the SMC and Merlin Gerin product lines under the April umbrella, and the convergence of April and Telemecanique in Schneider.

Airbus Industrie Official on Market Expansion Strategy

95WS0172A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 21

[Article by Jean Pierson: "Need for 13,000 Commercial Aircraft Between Now and 2011"—first paragraph is AIR & COSMOS/AVIATION INTERNATIONAL introduction]

[FBIS Translated Text] *Airbus, which hopes to capture 50 percent of the world market, will deliver its 500th A320 in 1995. Jean Pierson, 54, former chief of Concorde production and director of Aerospatiale Aircraft, has been administrator-director of Airbus Industrie since April 1985...*

Airbus Industrie is 25 years old. In this quarter of a century the European consortium has grown to become the world's second largest airplane builder, carving out a fitting role for Europe in the aeronautical industry and offering airlines the benefits of a competitive market.

Since its creation in 1970, Airbus has launched seven new aircraft and penetrated world aviation markets in the face of competition from such solidly established builders as Boeing and McDonnell Douglas. The consortium thus proved in concrete terms that pooling the human, economic, and technological resources of European industries was the key to success.

In 1994, for the first time, Airbus Industrie garnered more orders in the first nine months of the year than its American rival Boeing.

In 1995, Airbus Industrie will deliver its 500th A320. This will mark the first time a European aircraft production run has passed the 500 mark—a historic first for European aviation. To date, more than 1,800 sales have been made, while more than 1,200 aircraft have been delivered to 120 operators. Unthinkable only a decade ago, this record-breaking achievement confirms the wisdom of the consortium's strategy and lays a solid foundation for future development planning. For what Airbus gambled on—successfully—was designing and offering a gamut of products, beginning with the A300, that were technologically distinguishable from the competition. Coordination with client companies allowed us to identify market needs and respond to them, by optimizing aircraft profitability without ever sacrificing quality.

But our success to date is only one stage in Airbus's development. Our aim was to carve out an equitable market share for European industry.

So far we have won 30 percent of the world commercial transport market. The next step is to capture 50 percent, to consolidate our position. Over the long term, the world commercial aviation market is expected to grow more than 5 percent per year, which means the airlines will need 13,000 new aircraft between now and the year 2011. The greatest demand will probably be seen in aircraft in the 125-150 and 211-350-seat categories. If we factor in the clear trend of operators to move increasingly toward direct connections, especially in the Asia-Pacific region, an aircraft such as the A340 already meets perfectly the airlines' needs for flexibility and economy, allowing them to adapt to passenger traffic fluctuations without sacrificing frequency of flights.

Turning to the future, the European consortium already has a gamut of economical, environmentally appropriate, niche-targeted aircraft extending from the A319 to the A340, that range from short-range to very long haul carriers and embody quality standards that prove their worth day after day in terms of reliability as well as operator and passenger satisfaction.

The first generation of aircraft opened the way to technological and ergonomic improvements. The A320, A330, and A340 families then consolidated those advantages by introducing new but proven technologies that allow each model to meet a specific demand for efficiency and economy, while offering a degree of genuine commonality that gives operators a flexibility of use hitherto undreamed of. Today, Airbus is the only builder offering a family of aircraft that permits substantial economies in training and crew planning while at the same time strengthening flight safety. The profitability and well-earned success our concept has enjoyed shows the benefits of the continuous dialogue which Airbus has maintained with clients. From the first A300 in 1972 all the way to the very large commercial transport aircraft still in the planning stage, consultation with potential clients remains a constant, for both commercial and technical reasons. Likewise, we have steadily improved the quality of after-sales service, again with the goal of client satisfaction. The airlines, which have always been reluctant to change suppliers, have quickly discovered and appreciated the reliability and high performance standards of Airbus Industrie aircraft.

The future of the consortium depends now on consolidating its position, among other things by occupying all sectors of the market for aircraft in the 120+ seat category. It also depends on penetrating new Asian markets where significant growth is predicted, growth in which Airbus Industry hopes to play an important role. Whence the idea of a very large transport to complete the upper end of the current gamut. This project, provisionally dubbed the A3XX, could meet any need for a mass transport aircraft, for example situations in which an aircraft that seats more than 500 passengers could help reduce airport congestion and cut down on the need for more airport construction. This program could lead to widening Airbus's circle of partners. But conquest of markets also requires a flexible and effective instrument to finance aircraft sales. With the creation of Airbus Finance Company [AFC]—a sales financing company which, though independent, will work in collaboration with the consortium's marketing teams—AFC will be able to meet certain specific financing needs. It is by

consolidating its current success, expanding its product line, and promoting growth that Airbus Industrie hopes for further successes in the decades to come.

France: SFIM Expands Fiber-Optic Gyrometer Market Share

95WS0193A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 69

[Article by Jean Dupont: "SFIM Gambles on Fiber-Optic Gyrometers"; introductory paragraph in boldface as published]

[FBIS Translated Text] **The SFIM [Measuring Instruments Manufacturing Company], which already had access to Photonetics gyrofiber technology, has just taken over the German SEL's production unit. The SFIM is opening up its markets in aeronautics and defense to that line of business.**

The SFIM has just been selected by Eurocopter-Germany to equip its new EC-135 with a complete piloting system. That is the first commercial success to be recorded by the equipment manufacturer as a result of the program for new helicopter avionics that it has been pursuing in cooperation with Sextant Avionics since June 1993. On the EC-135, the two partners will share responsibility for the equipment as follows: the gyrometric and accelerometric sensors, the piloting computer with its man-machine interface, and the flight control servomotor will be assigned to the SFIM, while the air data system will go to Sextant.

The SFIM achieved that success in the face of U.S. competition from Allied Signal, whose high production rates in the field of helicopter avionics enable it to play with prices. To stay competitive in that context, the SFIM developed a new altitude and heading system (AHRS) that is light (three kg), compact (three liters), and equipped with conventional mechanical sensors, making it half as expensive to produce but identical in performance. To achieve that, the SFIM has invested 70 million francs [Fr] of its own money and is now seeking to expand the system's applications. In connection with the retrofit of the French Navy's Super Etendards, for example, it is offering an emergency system based on the same bloc of sensors.

While the SFIM's medium-term future in the field of helicopter piloting is assured thanks to this new line of equipment, the group headed by Pierre Poquin is already preparing for the next step. As this year [1994] comes to a close, the SFIM has just bought from the German firm SEL (Standard Electric Lorenz, a subsidiary of Alcatel-Alsthom) the latter's special shop for fiber-optic gyrometers (FOG's) and incorporated it into a new subsidiary, SFIM, Inc., that was established for the purpose. With a capacity of 50 units per month, that shop is a world leader in the production of fiber-optic gyrometers and exports its products to Japan for use in industrial robotics and to the United States for flight controls on drones. SFIM, Inc. also manufactures gyrofibers in the 5°/hr class for Euromissile's Polyphene engine and German Aerospace's KEPD-TADS dispenser (see AIR & COSMOS/AVIATION INTERNATIONAL No. 1498). SFIM, Inc. will supply a three-gyrofiber emergency system for the EC-135.

Long-Term Thinking

That buyout would pass unnoticed (it involves a turnover that is currently only about Fr10 million) if it were not a reflection of long-term thinking. It will be remembered that as far back as August 1993, the SFIM signed a licensing agreement on gyrofibers with Photonetics, a French PME [small or medium-sized business] that had already distinguished itself previously by selling its technology to Northrop in the United States (see AIR & COSMOS/AVIATION INTERNATIONAL No. 1373).

With those two acquisitions (the development capacity of Photonetics and the production capacity of its new German subsidiary), the SFIM now controls the entire FOG chain from start to finish. As is known, the market for altitude sensors is segmented on the basis of their performance and especially their drift. Today, high performance levels (with drift ranging from one-tenth to one-hundredth of a degree per hour) are the province of gyrolasers, which are used in the inertial guidance systems of airliners and warplanes. Lower performance levels are the domain of mechanical gyros, which are suitable for applications in helicopters, missiles, or sight stabilizers. That niche is now occupied by the SFIM.

Pierre Bloch, the SFIM's sales manager, says that "in the segment involving a drift of a few tenths of a degree per hour, gyrofibers are already competitive in terms of the traditional mechanical gyros." Sturdier and more reliable, they are also better adapted to severe environments. Lastly, the potential for improving their performance levels is greater than it is in the case of conventional gyros. If we add to that the fact that the niche for gyrolasers (which requires a tremendous investment in production) is already very crowded in Europe (SAGEM [Company for General Applications of Electricity and Engineering], Sextant Avionics, and British Aerospace), the choice of the gyrofiber line becomes obvious for the SFIM.

The SFIM's commercial prospects seem quite favorable. Because, as Pierre Bloch explains, "After starting from scratch, we succeeded in 10 years in winning 58 percent of the world market for tank commanders' sighting equipment, which has become a basic item of equipment on every tank of the new generation. Boosted by that new commercial success, we have decided to develop a new land navigation system based on FOG's in the 0.10°/hr class."

The SFIM is also interested in the development of highly accurate gyrofibers that can be used in its optronic fire control systems and especially in the more demanding

application of artillery stabilization. Those sensors will then move up easily to the same performance level as gyrolasers.

But gyrofibers, whose commercial breakthrough has been predicted for about 10 years, have been unable in all that time to do more than achieve restricted distribution except for use in robotics. But the fact that a group like the SFIM is interested in that type of sensor could well constitute the bridge needed by that technology to finally penetrate the aeronautical world. The time may no longer be so far away when aircraft will be carrying low-cost inertial guidance systems consisting of gyrofibers whose accuracy can easily be improved by resetting them by reference to the Global Positioning System (GPS).

Dassault Aviation 1994 Figures, Activities Discussed

95WS0244A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 10 Feb 95 p 16

[Article by Jean-Pierre Casamayou: "Dassault Aviation Wins Market Shares"]

[FBIS Translated Text] Its wings shortened so as to better pass through the turbulence being experienced by the aeronautical industry, Dassault is doing better than withstanding the storms. For 1994, the Dassault Aviation Group is announcing an order book up by 38 percent (to 18 billion francs [Fr]), with sales of business aircraft being especially good (see page 17 [not included here]). Those new orders are divided between orders from the French state (Fr6.6 billion), business aircraft (Fr6 billion), the contract with Qatar (Fr3.5 billion for 12 Mirage 2000-5's), and nonmilitary orders (Fr1.8 billion).

On the other hand, activity has continued to decline, with turnover down 6.8 percent to Fr12.4 billion. This year's activity will be about the same. As a result, layoffs are continuing, and total employment by the group stood at 11,700 at the start of this year, compared to 14,660 in 1990. "Barring a major disaster, we are nearing the low mark," says Bruno Revellin-Falcoz, vice president in charge of technical affairs, research, and cooperation.

Despite the lower turnover, Dassault Aviation has managed to stay profitable. Charles Edelstenne, vice president in charge of economic affairs and finance, confirms that the group's operating results will be on the same order as those recorded in 1993, when they totaled Fr311 million. The group's good financial health, reinforced by almost no indebtedness, is enabling the group to prepare for the future by investing massively in research and development activities. "We are financing over Fr1 billion worth of R&D with our own money," says President Serge Dassault. "And that financing is made possible by the profits we make from Falcon sales."

Over 2,100 employees, 55 percent of them engineers, devote themselves to R&D activities. And the effect of that very strong emphasis is to change the face of the group, which, in the words of Bruno Revellin-Falcoz, "is increasing its technical nature." In 1980, 53 percent of the personnel consisted of engineers and technicians, and 35 percent were concerned with production. Today the figures have changed to 76.5 percent in the case of the former and 12.5 percent in the case of the latter. The others are employed in administrative positions. The corollary of this is that over 30 percent of production is done by subcontractors.

Cooperating With Germany

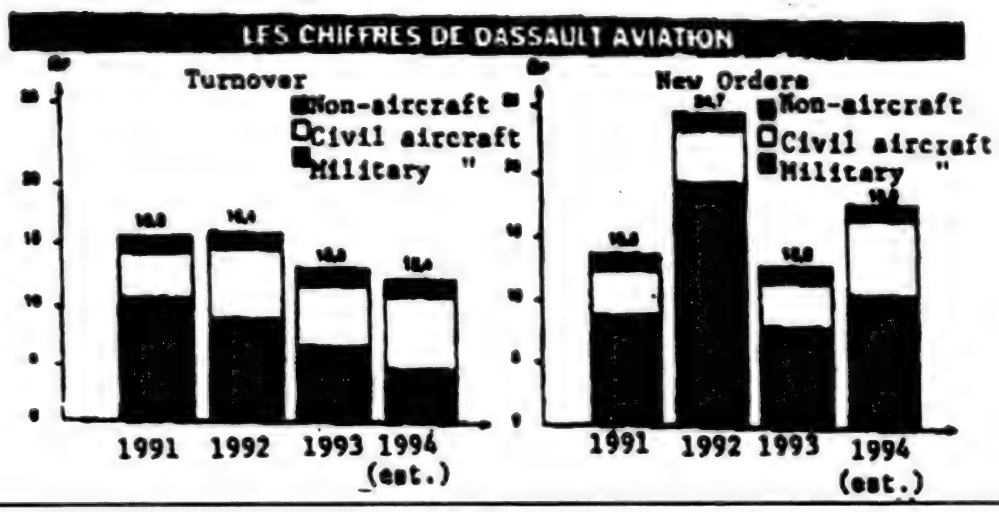
The other way of preparing for the future is to think about future forms of cooperation. The managers at Dassault Aviation claim that the group "has positioned itself to cooperate with European manufacturers." For example, "exchanges of ideas" have taken place with potential partners on the post-Rafale combat plane and future training aircraft. Serge Dassault has even stated that he is "open to cooperation with Germany if the EFA [European Fighter Aircraft] is not produced."

As far as its workload is concerned, Dassault Aviation has plenty to do while waiting for the (very slow) rise in the Rafale's popularity. Plans call for moving up very gradually to a rate of 16 aircraft per year beginning in 2002. One aircraft will be delivered in 1997 (Rafale B), six in 1998, five in 1999, eight in 2000, and 10 in 2001. But to meet the export demand, Dassault says that "every step is being taken to be able to produce two Rafales per month beginning in 1999." Current forecasts mention 86 Rafale M's for the French Naval Air Fleet and 235 Rafale Air units (60 percent of these are two-seaters) for the Air Force, whose chief of staff estimates that 200 more units will be needed by 2005 (see AIR & COSMOS/AVIATION INTERNATIONAL No. 1503, page 5).

Production of the Mirage 2000 remains the major activity today, with 70 Mirage 2000-D's still to be delivered for the Air Force (with the conversion of 37 Mirage 2000-RDI's into Mirage 2000-5's), as well as 72 Mirage 2000-5's for Taiwan and Qatar (deliveries will begin next year). On the other hand, production of the Atlantic II, with five units still to be delivered, will cease. Unless there is a foreign order (from Great Britain or the Middle East) to start up the production line again. In the case of trainers, Dassault is gambling on two bidding processes (in India and Australia), in both of which the Alpha Jet has the advantage of being the only candidate being offered with an assembly line.

Concerning its future as a manufacturer of fighter planes, Dassault feels that that future still exists despite the new deal of the geostrategic cards. For example, it has calculated that out of a worldwide fleet of 26,000 fighter aircraft, 6,000—notably 2,500 F-5's and 1,500 Mirage III's—are reaching the end of their useful lives. Taking a very conservative approach, that represents a potential market for 3,000 aircraft over the next 10 years—an average of 300 planes per year. Of that total, the aircraft manufacturer, which once enjoyed from 12 to 14 percent

Dassault Aviation Group Figures: Turnover and New Orders (in millions of francs)



of the market, hopes to retain between 7 and 10 percent. That would mean from 20 to 30 aircraft per year—a workload sufficient to strengthen the group's activity in its new configuration.

[Box, p 16]

Robotized Bed for Rafale Wings

As part of Dassault Aviation's reorganization in response to the market's globalization—a change necessitating an improvement in industry's ability to react—the aircraft manufacturer has chosen to assemble the Rafale's wing structure using the system developed for the Mirage 2000. Work to set up the line for assembling the Rafale wing structure has already started in Martignas, the only wing structure assembly center for all of Dassault's civilian and military aircraft. The assembly jigs, newly painted light green (characteristic of Rafale jigs) and ready for installation, are now awaiting only the arrival of the new robots, to which will be added computerized command and control and the effectors for the robot manipulators.

Two robots will work on each side of the jig. But unlike the assembly beds for Mirage 2000 wings, these will probably be ABB robots (although the ABB's are still competing with a Fanuc robot), because the anthropomorphic Cincinnati robots in use previously lack sufficient clearance for the Rafale wings. So far, the Martignas plant, which has also adopted robotization for the Falcon's wings, is using 12 robots and relying on the experience gained from the robotized production of 350 Mirage 2000 wing kits out of the 535 aircraft produced.

The robotized assembly bed for Rafale wings will exhibit an important innovation in comparison with that for the Mirage 2000's. To drill the hole in which the robot will position a screw or rivet, Dassault Martignas has developed a piece of equipment making it possible, by means of a torque limiter, to modify the cutting data (rotation speed, cutting feed, and so on) as a function of the effort generated by the materials to be drilled, notably titanium and carbon.

France: SNECMA Capital Injection, Mergers Discussed

95WS0221A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 17 Feb 95 p 11

[Article by Jean-Pierre Casamayou: "A Capital Increase for SNECMA (National Aircraft Engine Research and Manufacturing Company)"; AIR & COSMOS/AVIATION INTERNATIONAL introduction is "At the same time the turboprop consortium for the FTA [Future Transport Aircraft] is getting off the ground, the state is expected to recapitalize the engine maker."]

[FBIS Translated Text] France's minister of Defense, which overseas SNECMA, applied some balm to the engine maker's wounds during his visit to the manufacturer's Melun-Villaroche facility on Friday, 10 February. Francois Leotard softened CEO Bernard Dufour's sense of abandonment (see AIR & COSMOS No 1402) and confirmed that differences over the famous two-percent drop in prices were on their way to being resolved. Most important, however, Leotard expressed his confidence that the government would invest two billion French francs [Fr] in the company. "The state is very concerned about SNECMA's future," affirmed the minister. "France would have to be blind to abandon its aircraft engine industry."

This piece of good news, which will not become a reality until given the nod by the budget ministry sometime in March or April, comes at just the right time for SNECMA. A drop in sales and the financial burden of development work are driving up the company's losses.

Although Bernard Dufour had announced 1994 losses exceeding those of last fiscal year (Fr692 million for the parent company and Fr800 for the group), they will apparently top Fr1 billion.

The other important topic raised during the visit was the proposed M138 turboprop engine for the FTA future transport aircraft. Over the next few weeks SNECMA, MTU [Motor and Turbine Union, Inc.], and Fiat will ratify their agreement to work together by setting up an ad-hoc consortium. The French and German partners will each kick in 36.5 percent of the capital, and the Italian firm 27 percent. An earlier article in AIR & COSMOS No 1474 described the technical division of labor. In addition, the three manufacturers have agreed to open up the consortium to future partners, among them Spain, Turkey, Portugal, and of course Great Britain, despite England's involvement in BMW Rolls-Royce's competing proposal for the BR710. The revised and corrected program costs were disclosed during the minister's visit. The figure now quoted to develop and industrialize the turboprop is Fr4.6 billion (in 1994 French francs, excluding taxes), with a unit price of Fr16 million for each engine. The price tag for all FTA engines (four powerplants for each of the 300 planned aircraft, including spares) would total Fr20.7 billion before taxes, with France's share coming to Fr7.6 billion. SNECMA is expected to invest Fr1.5 billion in development, to be financed either through a DGA (General Weapons Delegation) contract or reimbursible loans.

Finally, the minister's visit confirmed that although collaboration with General Electric would remain the rule for non-military engines, preference will be given to Rolls-Royce for joint military projects. This primarily means the joint research program HAMET, which got underway in 1993. The program aims to build a military aircraft engine to replace the M88s and EJ200s after 2012.

France: SPOT Image Turnover Up in 1994

95WS0221B Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 17 Feb 95 p 11

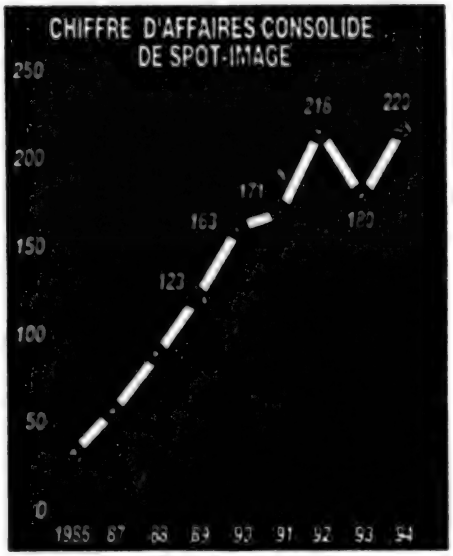
[Article by Christian Lardier: "Renewed Growth for SPOT in 1994"; AIR & COSMOS/AVIATION INTERNATIONAL introduction is "After a tough 1993, SPOT Image racked up consolidated sales of 220 million French francs [Fr] in 1994."]

[FBIS Translated Text] By exploiting both SPOT-2 and SPOT-3 satellites in 1994, SPOT Image was able to better its 1993 sales of Fr180 million, and even surpass the Fr218 million it racked up in 1992.

Cumulative sales since SPOT-1 became operational in May 1986 total Fr1.2 billion, 80 percent from exports. The greatest growth has been in the United States, where sales increased 50 percent over 1993. SPOT Image Corp did much of its business there with government agencies in the agriculture industry, as new applications surfaced for that market. The increase boosts the United States to first place among user countries, while North America's 22-percent market share is approaching Europe's still considerable 25 percent of total sales.

SPOT Image has also experienced significant growth in the Asia-Pacific region. Its Sydney, Australia (SPOT Imaging Services created in 1989) and Singapore (SPOT Asia founded in 1992) subsidiaries racked up nearly 23 percent of the company's sales. Thanks primarily to the Japanese market, the region's sales performance ranks among the best. The credit for SPOT's expanding world market lies with its international sales network of 80 agents and its 17 receiving stations. The stations are located in France, Sweden, Canada, the Canary Islands, Brazil, Thailand, Japan, Pakistan, South Africa, Australia, Saudi Arabia, Israel, Ecuador, Taiwan, Indonesia, and Germany, home to the American Eagle Vision station.

SPOT-2's recorders, which were launched 22 January, 1990, suffered a breakdown in 1993, but the satellite is still used when directly visible to the receiving stations. SPOT-3, which was launched 26 September 1993, will be operational until October 1997, the scheduled launch date for SPOT-4. The decision to construct the SPOT-5A and SPOT-5B satellites was made in October, 1994. They will be launched in 2002 and 2007 respectively. (The life of a SPOT satellite, which was two years for SPOT 1-3, has increased to five years for SPOT-4 and 5). Together, all these satellites should enable SPOT Image to hold on to one of the top, if not the top, spots in commercial remote-sensing until 2012.



Consolidated Turnover for SPOT Image

France: Strategy Issues Facing Software Engineering Firms Analyzed

95WS0262A Paris L'USINE NOUVELLE in French 23 Feb 95 pp 18-20

[Article by Franck Barnu: "Four Ways for SSIIs to Bounce Back"]

[FBIS Translated Text] *The crisis has revealed the weaknesses of software service providers, particularly for the leading firm, Cap Gemini Sogeti. To adapt to the market and face up to new competition, these companies are now revamping their products around the keyword "industrialization."*

Daimler-Benz, which now holds 34 percent of Cap Gemini Sogeti, has until February 1996 to increase its holdings in the leading European SSII (Data Processing Services and Engineering Company). Last week, Heinz Achlinger, head of Daimler's computer subsidiary, Debis Systemhaus, concurred by stating that "greater Daimler participation is absolutely justified from an operational standpoint."

This renegotiation comes at a turning point for Cap. Even though the enterprise, headed by Serge Kampf, has again shown a profit—20 million francs [Fr] in the second half of 1994—it has experienced three years of losses.

This tailspin for the foremost and brightest of the French SSII illustrates if nothing else the upheavals which have recently affected the world of software and services. After years of euphoric growth, the sudden slowdown of the market revealed an accumulation of fundamental SSII problems which growth had completely masked: the increasingly poor adaptation of services relying solely on personnel delegated to develop specific software programs, the lack of long-range planning, minimal strategies, and hyperinflated structures designed for a perpetually expanding market.

Along with an in-depth reevaluation of their mission, the French SSII have seen new competitors emerge: software manufacturers, telecom carriers, software publishers. Not to mention the threats from above, coming from major auditing and consulting firms, such as Andersen Consulting, which know how to address the general and operational offices that have replaced computer managers as privileged computer information sources.

Of course there still remain requirements which can only be met by specific development. There is still room for delegated personnel. In fact, despite a greatly diminished demand, a number of small and medium SSII are currently thriving in this niche. Others have been able to position themselves on the most promising markets, as Sema Group did with systems integration, or CGI (bought by IBM) with software packages.

But no one holds any false hopes anymore. The all-purpose SSII will not rise again from its ashes. The years of wild growth are a thing of the past, and the software context as well as the needs of users have changed too much to allow a return to the old status quo.

Even with a recovery which is long in coming in France in any case, Jean-Franois Perret, general director of Pierre Audoin Conseil, does not expect more than a 5-percent to 6-percent growth in computer services, while he estimates that the German market will grow by about 8 percent, and the English software and services market by 10 percent to 12 percent. But not all the service enterprises have remained idle. The most aware of them—and woe to the others!—have thus come to adopt the credo of Bernard Bourigeaud, CEO of Axime, an SSII which is often cited as a model: "It is no longer possible to be a jack-of-all-trades. You have to choose the areas where you can become a leader. You have to sense profitability at all levels, which saves you from getting involved indiscriminately. Finally, you have to know the customer and be able to provide superior service quality, which also means you have to limit your field of activity." These pronouncements, which would be remarkable coming from any businessman involved with a competitive market, become revolutionary in the world of services. It is hardly surprising to hear them uttered by a man like Bernard Bourigeaud whose background is in industry. While the founding fathers of SSII stand aside, there are increasingly many like him who are now taking the reins of service companies. No doubt this new blood will ease the transition toward an industrial approach to service.

In order to reposition themselves, second generation SSIIs have stressed or are now stressing four major approaches.

1. Industrialization of Products

Generalist SSIIs have always lived off gleanings, meeting customer demand with custom-tailored response. This is no longer enough. They must now cultivate their fields, sell themselves, and differentiate themselves. To this end, they are all more or less rushing to prepare catalogs of services. This is not to be confused with software programs, even if these may be included. But the basic offer is for services, that is, "packaged" services, focused on clearly identified requirements, with perfectly spelled out rates and terms.

Implementing such a catalog reflects another incentive. This industrialization makes it possible for SSIIs to invest know-how in a specific product, to recover existing development, and thereby to significantly reduce the cost of the provided services. Customers expect no less.

Michel Rios, CEO of Whatever, a service marketing specialist, notes that "today, this is the hot topic among all service providers. SSIIs are focussing particularly on large markets for systems integration and on global approaches to specialization-customer."

A typical example is the DCS (Distributed Computing Services) product of Cap Gemini Sogeti. This consists of an array of services, appropriately priced as a function of level of service, with service commitments and designed to fill a very specific need: implementation, support, and maintenance of distributed systems.

For the SSIIs, this is a radical change in culture and practice. As a result, the enterprises must now ask themselves such questions as "What product? For what market? What packaging? At what price?" In a sense they are discovering marketing, where they are lagging far behind software manufacturers and publishers.

Industrialization also brings them the opportunity to discover the advantages of investment. Industrialization does not come free, whether it involves defining services, developing methods, or implementing a commercial structure. Cap Gemini Sogeti has spent more than eighteen months and invested about thirty man-years to fine-tune its DCS product.

2. The Need to Internationalize

Whether they want to or not, SSIIs must now internationalize. It is no longer a matter of merely branching out into new countries to win new markets, but a question of universalizing the product, to go "global" as the Anglo-Saxons put it.

There is at least one good reason for this. Their most important customers are all already seriously committed to the globalization of their activities. This forces the SSIIs to show that they can offer the same level of quality and of service no matter where in the world the customer is located. It forces them to offer world-class service in order to stand out. In other words, they must be at the top of the class.

Globalization is currently still much more advanced on paper than in practice. EDS, securely camped in two fields—systems integration and outsourcing—is probably the service enterprise that comes closest to it today. It restructured itself in this respect two years ago and now swears by the slogan: "Think global, act local."

The French are clearly determined to achieve internationalization, but they still have a long way to go. Sligos, for instance, is still at the early stage of Europeanization, started in 1990: Henri Pascaud, CEO of the computer subsidiary of Credit Lyonnais, states that "this was when we understood how important this was to our customers." After organizing its major departments at the European level, Sligos is now reorganizing its resources on a European basis, by specialties (automobile, bank, telecoms). As for CGI, taken over by IBM—Christian Nivoix, former head of IBM services, has just assumed its lead—there is a clear intention to universalize the software programs offered by the company.

Enterprises like Sema Group, Cap Gemini, or Syseca are already present where they can make a difference in world-wide terms. This is the case for Sema with billing systems for mobile telephones and defense control systems; for Syseca, with automation of the Metro, and for Cap Gemini with defense and telecommunications. But so far these worldwide activities amount to no more than one-third of their revenue.

Lastly, this internationalization is completely inseparable from the product industrialization that it creates and justifies. It is the only way to meet its enormous costs. Sema Group estimates Fr80 million to Fr120 million for the investments to implement the software designed for mobile telephones.

3. Software Engineering

Except for very specific instances, SSIIs are less likely now than ever to develop software packages. This is a specific niche, which is itself undergoing globalization and requires colossal investments, rapidly running into hundreds of million francs.

On the other hand, service providers have all understood the value of achieving integration around software. Alain Lemaire, former head of Cap Sesa who is now strategic SSII consultant for PLC, says that "Fr1 of software generates Fr5 to Fr10 worth of services." This is where providers can expend the energy they formerly brought to technical support. All the SSIIs are now swiftly converting their specialties to software integration. There is a rush toward industrial management, particularly around SAP's R/3 software program. Pascaud, Sligos CEO, says "it is an unavoidable revolution. Eventually, all general-purpose software programs will be standard products."

This rise of software engineering is much more resource-intensive than older specialties. Lemaire says, "It is much harder to form capable teams for multiple software packages than for different operating systems." Cap Gemini Sogeti has earmarked an estimated Fr15 to Fr20 million to create a pool of 70 SAP experts in France.

4. Ongoing Services

SSIIs which formerly limited themselves to ad hoc services, are now searching for the manna of steady revenues, either by implementing an arsenal of services which might earn them client loyalty, or by developing ongoing services.

The most desirable service of this type is of course data management, and it has been a life raft during the recent stormy years. Data management contracts commit the customer for a long term—a minimum of three years—and it is no coincidence that all service providers vaunt the advantages of seven-year or ten-year contracts. In addition, by categorizing—operational data management, maintenance, application maintenance, computer equipment management—data management makes it possible to build up a range of services which fosters client loyalty.

Finally, there is one last path for going further in this direction. Service providers can commit themselves more deeply, by investing in "turnkey" service, which subsequently provides a regular income. This is what Sligos has done for a long time, with the management of card distributors for which it gets paid per transaction. This is also Axime's source of success with its telematic servers. SG2 is doing the same by investing in call centers (Fr20 million).

For SG2, this rise to strength in what some call added-value service, is built on strategy: Geroges Grima, CEO of the Societe Generale subsidiary, asserts that "our objective for the next five years is to become a company which provides services with an added high technological value." For him, the future is no longer in the sale of computer technology but in the sale of services which relieve enterprises from the burden of performing complete functions. In other words, for SSIIs, the future would seem to lie rather in "S" as in services rather than in "I" as in information.

Ranking of French Service Providers

	'93 Revenues in France (million francs)	'93 Total Revenues (million francs)	'93/92 Growth (in percent)	Major Shareholders
Cap Gemini Sogeti	2,998	11,000	-7.4	Sogeti SA (34% held by Daimler-Benz)
Sligos	2,744	3,815	+4.7	Credit lyonnais
Axime	1,853	1,899	-12.2	Paribas
GSI	1,634	2,588	+0.6	GSI Participation SCA
Sema Group	1,464	4,317	+8.6	Paribas/France Telecom
Telesystemes	1,453	1,603	-8.4	Cogecom (France Telecom)
CGI	1,224	1,933	-4.4	IBM
Syseca	1,190	1,814	+13.7	Thomson-CSF
SG2	1,102	1,140	+6.1	Societe generale
Cisi	995	1,452	-5	CEA

Sources: EUROSTAF-PAC

[Box, p 20]

Cap Gemini Sogeti: One Billion Francs For A Reorganization

Until 1992, the European leader in services appeared more like a federation of PMEs (small and medium-sized enterprises) than a coherent group. The Genesis program, which was allocated Fr1 billion, has enabled Cap to renew its range of services and its methods, and to reorganize its operations. Today the enterprise is structured at three levels:

Level 1, for the agencies which sell products on a territory; the Market Development Units (MDU) which commercialize part of the products or which take action in a specific sector; and the Skill Centers, which produce software and systems for the MDUs and the agencies.

Level 2, for the operations divisions (46 in all) include the base units from level 1 and use their skills to adapt to the market, to its resources and to its customers.

Level 3, in which seven Strategic Business Areas have been defined. Each of them is established in a country with a twofold responsibility: a regional one, which sells and provides services in the given country; and a sectorial one, which aims to develop worldwide a market share in a specific economic sector.

France: Bull's 1994 Business Performance Report Judged Positive

95WS0262B Paris L'USINE NOUVELLE in French 23 Feb 95 p 25

[Article by Franck Barnu: "Bull on the Right Track"]

[FBIS Translated Text] With Bull showing an operating profit of +237 million francs [Fr] for 1994, what is important is not the absolute figure itself, but the remarkable "+" sign, even if the net result still remains very negative. After years of colossal losses, to show the first positive result since 1989, within weeks of privatization, is either something of a miracle or some "clever way of presenting results," as some have not hesitated to think.

But it is undeniable that for the first time in five years, the French manufacturer can show a rise in revenues: +6.9 percent, at Fr29.9 billion, after an average downturn of 9 percent per year for the past four years. Jean-Marie Descarpentries, the company's CEO, stresses this point above all others: "The computer industry is certainly in transition, but it is a growing industry and a profitable one. It is crucial to have checked this downward spiral." He further states that "the world market is growing by 7.7 percent. Given currency parity and a constant perimeter, Bull is doing better, with a growth of +8.2 percent."

Future Bull shareholders (Quadral, NEC, Motorola, Sequent — an American multiprocessor Unix systems

maker, and IPC—a PC manufacturer from Singapore, are currently the most likely prospects) will therefore find a much improved situation.

The year 1994 was marked by a spectacular improvement in cost structures: fixed non-salary costs went from 36 percent to 30 percent of revenues. The same progress held for salaries (from 40 percent to 34 percent), while financial costs went from 4.3 percent of revenues to 1.7 percent. The total savings amount to Fr3.2 billion.

Purchases Under Scrutiny

As a result, purchases, which climbed from 30 percent to 36 percent of revenue during the same period, have become the first cost item. Descarpentries' immediate reaction is that "purchases will be the first key indicator in 1995. The goal is to reduce them by 15 percent."

The same personality who has every intention of heading Bull as a private enterprise, will also keep an eye on the enterprise's productivity. He aims for a revenue growth of 8 percent per year per employee, saying that "this is the average annual improvement rate of our five leading competitors, and the same is essentially true for other industries like cars, glass, or packaging." Bull, which had accumulated considerable negative assets, has improved this aspect by a significant +20.4 percent in 1994. But the CEO warns that "there are very great disparities between units, where productivity improvement varies from +1 percent to +45 percent! This will be our second key indicator."

[Box, p 25]

1994 Results

Revenues: Fr29.9 billion (+5.9 percent); Operating profit: Fr237 million (-1.9 billion in 1993); Net result: (except for Fr1.3 billion allocated to restructuring) Fr-660 million (-3.4 billion in 1993)

Sweden: Saab Scania Reorganization Opens Door to Civil Aircraft Partners

95WS0258A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 3 Mar 95 p 12

[Article by Bernard Bombeau: "Saab, Scania Become Independent"; introductory paragraph in boldface as published]

[FBIS Translated Text] **Saab, Inc. is keeping the former Saab Scania group's aeronautical and military activities in a repositioning that might facilitate the arrival of possible partners in its civil aircraft branch.**

This operational change, ordered by Saab Scania's board of directors on 22 February, will take effect at the group's annual general meeting on 16 March. It confirms a process of restructuring the edifice that Peter Wallenberg has controlled since 1991 through the Investor Company. The new Saab, Inc. group (aeronautics and defense) will consist of five production companies—Saab Military Aircraft, Saab Dynamics, Saab Training Systems, Saab Aircraft, and Saab Combitech—and Saab Service Partner. The first three of those companies are directly involved in the military sector, and they will be part of a common entity known as Saab Defense.

The five companies placed under Saab, Inc. will have a new president on 1 April: Bengt Halse, former general manager of Ericsson Microwave Systems. Saab, Inc., whose turnover is around 3 billion French francs [Fr], will have its head office in Linkoping, and it will employ 7,800 people. That aeronautical branch's civilian and military activities posted a combined loss of about Fr380 million in 1994. Scania, Inc. (trucks), which employs 20,400 people, makes an annual profit of Fr2.7 billion, and the figure is rising steadily.

Waiting for Partners?

This restructuring puts an end to the agreements between the Saab Scania group and the coordinating group set up between Saab and Scania, with Lars V. Kylberg scheduled to leave his post as CEO on 16 May. Saab, Inc. and Scania, Inc. will be considered fully-owned subsidiaries of Investor. Saab Automobile's 50-percent interest in the Saab Scania Holding Company will be transferred to Investor. Saab, Inc. and Scania, Inc. will constitute two different industrial companies, each with its own board of directors. Saab Scania Finance will continue to be part of Investor Group Finance, which is responsible for financial coordination.

The reorganization is not innocent, of course. Presented officially as being a matter of achieving "a better concentration of activities," it also has the advantage of better isolating Saab Aircraft's purely civil aeronautical activities, Saab Aircraft being the firm acting as prime contractor for the Saab 340B and Saab 2000 regional aircraft programs. This repositioning might facilitate the arrival in the near future of a new partner, as occurred five years in the case of Saab Automobile, 50 percent of which is now owned by General Motors—a subject that remains very much an issue in the European aeronautical industry (see the report on pages 22-26 [not included here]).

On the other hand, the Scania branch, which is exceptionally profitable, might find half of its shares being reintroduced into the stock market as a means of mopping up some Fr2.4 billion worth of the Investor group's debt and preparing for the arrival of one or more partners.

Germany: Fokker Announces Fourth Reorganization in Three Years

95WS0258B Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 3 Mar 95 p 12

[Article by B.B.: "New Restructuring at Fokker"; introductory paragraph in boldface as published]

[FBIS Translated Text] **The Dutch aircraft manufacturer is eliminating 1,760 jobs, closing two plants, and slowing its rate of production.**

The subsidiary of Daimler Benz Aerospace (DASA), which owns a 51-percent interest in it, announced on 27 February its fourth restructuring plan in three years. Of its current 8,500 employees, 1,760 are going to lose their jobs, notably as a result of the closing of the Amsterdam-Zuidoost plant and the facility in Ypenburg near The Hague and a cutback in activities by its engineering department. Furthermore, the head office, currently in Amsterdam, is going to move to Schiphol International Airport, where most of the fabrication and assembly activities are concentrated. The specific activity of metal-to-metal bonding will be transferred from Ypenburg to the Papendrecht facility, and activities involving composites will move to Hoogeveen. Overall, the manufacturer, which specializes in 50- to 100-seat regional aircraft, will probably see its employment figure drop to 6,600 by mid-1996, "the year of an expected return to profitability."

But this fourth plan is very likely to be simply one more stage in the restructuring of the firm, which is thinking of transferring its space activity (Fokker Space Systems) to the Dutch Urenco group with a view to "Fokker's refocusing on its traditional activities as an aircraft manufacturer."

This plan for economizing calls for reducing wage costs by 10 percent and structural charges by 20 percent, and it will be accompanied by a renegotiation of outside contracts for supplies and subcontracting, involving mainly cooperation agreements with the British engine manufacturer Rolls-Royce, the Canadian Bombardier group, and the latter's subsidiary Shorts. A new organization known as Fokker Aerostructures will take charge of all matters pertaining to supplies; at the moment, two-thirds of a finished aircraft's components are supplied by subcontractors.

The difficulties at Fokker, whose losses in 1994 are expected to be the same as those in 1993 (1.5 billion French francs [Fr]), are due, of course, to the decline of the dollar and European competition in the regional aircraft market, but also to the situation with the company's equity capital. The 1 billion guilders (Fr3 billion) used last year to recapitalize the firm were clearly not enough to absorb the debt, finance the various social plans, and straighten out the company's accounts.

The marriage between Aerospatiale, Alenia, and British Aerospace somewhat increases the company's isolation in the DASA fold. DASA is unwilling to grant more financial help, and no such assistance appears as part of this fourth restructuring. The Dutch aircraft manufacturer's financial situation is now a serious handicap from the standpoint of the partnership negotiations underway at the European level. For 1995, Fokker intends to produce a maximum of only 50 aircraft of the Fokker-50 twin turboprop family and especially Fokker-100's and -70's, on which the company's future now depends.

Germany/UK: BMW-Rolls Royce President on Expansion Strategy

95WS0179A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 31

[Article by Albert Schneider: "New Engine Technologies"—first paragraph is AIR & COSMOS/AVIATION INTERNATIONAL introduction]

[FBIS Translated Text] *BMW-Rolls Royce wants its share of a civil engine market estimated at $300 billion. Albert Schneider is president of BMW-Rolls Royce AeroEngines, a joint subsidiary of British engine builder Rolls Royce and German auto and engine builder BMW...*

The aerospace industry is one of the most important in the world, often working on the cutting edge of science to give birth to products of high value-added. And it is essential for the developed European countries to have a strong position in it.

Despite the recession in the commercial aviation industry, unmistakable signs of future recovery are beginning to emerge. They lead us to believe that for builders of civilian aeronautical engines the next 15 years hold promise of a market that could reach as high as $300 billion, or 1,650 billion French francs [Fr].

But the technology that will be needed to exploit that market can only be realized, for economic reasons, through cooperative endeavors such as ours. And cooperation has already brought success to our young European company.

BMW-Rolls Royce today is the only airplane engine builder that is augmenting its capacities. By quickly establishing ourselves as a self-standing European airplane engine builder, we have reached our first objective—and ahead of schedule.

Our enterprise has created a "niche" for itself and is now developing strategies to extend its activity beyond the family of BR700 engines already launched successfully on the market. Expanding this gamut to engines of higher and lower thrust than the BR700 is also going to require new environmental technologies.

In addition, we are paying close attention to the future European military transport aircraft, the ATF/FLA. Europe has urgent need of such an aircraft, and BMW-Rolls Royce has offered to fit it with a turbojet based on

the BR700. Our offer to Euroflag on this subject entails European partnerships that can be widened if necessary.

However that may be, one thing we are going to need to reach our aim is adequate manpower. This will be critical to the success or failure of our endeavor. The skills of our employees, their motivation, and the climate of the workplace must mesh with the tasks we are demanding of them. Bringing together personnel from a number of different nationalities has stimulated new ideas. Providing a work environment where everyone can make full use of his own expertise and take advantage of the know-how of others, an environment in which we can make optimal use of these frequently exceptional talents—such is the dynamic basis on which the team spirit of our enterprise thrives.

But in concrete terms, what is responsible for BMW-Rolls Royce's success? We think there are several factors.

First, our partners. We have the advantages of a good reputation in the industry, financial strength, and the technological know-how of our two parent companies as well as the other airplane engine builders with which we have ties.

Our independence is another key factor. More than a mere program partnership, we are an independent enterprise, and we are strongly committed to maintaining our status as a self-standing manufacturer of aeronautical engines.

Second, the market is favorable for the niches we have chosen. From the beginning we have targeted specific markets: long-distance, large-capacity business jets and short to medium-haul regional air transports. It turns out that these two markets are showing good demand, and they have considerable growth potential.

The family of engines we market is also obviously a critical element. Our whole concept for meeting market needs is to combine the lowest possible cost with flexibility and responsiveness in the development and manufacturing process.

Our horizontal organization, its international character, the creation of a new team, and our initial commercial successes have also encouraged the high level of motivation we have in our company.

Another factor is the site we have chosen for our new production plant: Dahlewitz, situated amid the green expanses of former East Germany in the Land of Brandenburg, near Berlin. We decided on this site early on, and the plant went quickly into operation, while offering good potential for expansion.

Thus in a few short years BMW-Rolls Royce has emerged, from the alliance of two major world players in the industry, to become a self-standing airplane engine builder with the promise of being a key player on the European aeronautical scene of the year 2000.

UK: Rolls Royce Head on Past, Future Production

95WS0178A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 30

[Article by Ralph Robins, president of Rolls-Royce: "Growing Interest in Big Engines"—first paragraph is AIR & COSMOS/AVIATION INTERNATIONAL introduction]

[FBIS Translated Text] *Sir Ralph Robins (knighted by the Queen of England) has been president of Rolls-Royce since 1992, and is also president of the British Council of Defense Industries.*

Back in 1963, about the time AIR & COSMOS published its first issue, Rolls-Royce was engaged in research on high-dilution-ratio turbojets for civilian airplanes. It quickly became apparent that the design concept of three independent housings offered many advantages, including that of a shorter and more rigid engine.

Today, the concept has proven itself successful, giving birth to the family of RB211 engines and now to the big Trent 700 engines that will go into service next month on Cathay Pacific's first A330. While in the past we participated in providing engines for the A320 and A321, with the International Aero Engine (IAE) V2500 turbojet, this is the first time an Airbus will be equipped with a 100-percent Rolls-Royce-built engine. In addition, a more powerful version, the Trent 800 destined for the Boeing 777, will fly for the first time in 1995. McDonnell Douglas's MD-90, fitted with the V2500, and the Tay-powered Fokker 70 will go into service in 1995, while the new BR710 built by BMW Rolls-Royce will also make its first flight this year.

These developments are going to put on the road to recovery a transport industry that is expected to begin turning profits again after four consecutive years of losses amounting cumulatively to almost $20 billion (110 billion French francs [Fr]). Nevertheless, there should be a very modest upturn in civilian aircraft orders in 1995 for deliveries in 1996-1997.

The market for high-powered jets has excited growing interest at a time when big twin-engines—the A330 and Boeing 777—are just making their appearance in the market. Many companies are waiting to see how they operate before they commit themselves to a strategy and order new equipment.

The lion's share of turnover derives from less powerful engines. The RB211-535 dominates the Boeing 757 market, and orders continue to flow in, while in the 100-seat niche the market for the Tay and BR700 is very active.

Over the next five years, which will take us to the dawn of the next millennium, air transport could see far-reaching changes, if "super-jumbos" play an increasingly important role. This in turn will depend on the pace of development of airports and their infrastructure.

With or without governmental assistance, the "shaky" airlines will probably disappear. The question today for Rolls-Royce, and for all other engine builders, is whether the airlines are going to order more existing aircraft or demand new models.

Some of the engines for these airplanes have already been developed—the Trent for the future very large aircraft as currently envisaged—while others, such as the BR710 for the Global Express and the BR715 for the MD-95, are still under development.

It is unlikely that any totally new engine will see the light of day in the next few years. But development methods are advancing, especially with the emergence of computer virtual design techniques.

There is still room for improvement in the science of engine design. Specific consumption can be reduced, use of new materials can cut down on weight, and reliability and maintenance can be improved.

The drastic reductions in defense spending throughout the world have radically altered military aviation during the last five years. In the early 1990s, Rolls-Royce's military sales dropped by half. But today supply is back in balance with demand.

With the four-partner EJ200 program for the Eurofighter 2000, we have developed the world's most modern warplane engine. In addition, there is still considerable demand for trainer craft. The U.S. Navy is using the Adour, a Rolls-Royce Turbomeca engine, on its T-45A Goshawk. Orders keep coming in for Adour-equipped Hawk, while the Lockheed T-Bird II powered by Viper is one of the alternatives for the U.S. J-PATS program.

The Harrier, and its AV-8B version powered by the directional-thrust Pegasus, will continue for some years to be the only VSTOL (Very Short Take-off and Landing) warplane in the world. Rolls-Royce is also participating in the proposed new VSTOL for the 21st century.

If the requisite approvals are forthcoming, we expect our gamut of civilian and military engines to be bolstered by acquisition of Allison, a U.S. company. The green light from the British Government for acquisition of 25 Lockheed C-130J military air transport aircraft powered by the Allison AE2100 augurs well.

This acquisition strengthens Rolls-Royce's position in both the civilian and military (planes and helicopters) sector. But even without Allison, Rolls-Royce could have supplied the engines for 80 percent of the civilian aircraft between now and the year 2000. By the year 2010, that ratio could exceed 95 percent.

Rolls-Royce has built up this strong position by means of its own products, such as the Trent built with its partners in France, Germany, Spain, Japan, and the United Kingdom. But also by participations and cooperation agreements for programs such as the BR710 (BMW Rolls-Royce), V2500 (IAE), and EJ200 (Eurojet). Or again, with Turbomeca in the Adour and RTM322, and the MTR390 program.

Rolls-Royce will continue to cooperate wherever cooperation is consistent with its long-term strategy. The next 10 years will be decisive for consolidating Rolls-Royce's position. Our goal is to master the technologies necessary for future engines and to make our technological and industrial contribution to a strong European aeronautics industry.

UK: ICL Poor Business Performance Explained, New Strategy Presented

95WS0268B Paris LE MONDE INFORMATIQUE in French 10 Mar 95 p 32

[Article by Philippe Rose: "ICL Stakes Everything on Services and Microcomputing"]

[FBIS Translated Text] **After a fiscal year much less rosy than predicted, ICL [International Computers Limited] is moving at breakneck speed into services and PCs...**

Fiscal year 1993: up 6 percent, fiscal year 1994: up 1 percent. This sudden drop in turnover growth rate more than ever forces Japanese-British manufacturer ICL (Fujitsu controls 84 percent of the capital, the rest being in the hands of Northern Telecom) to find success in the services sector. Year in and year out, services already generate about half the builder's gross earnings, but now ICL must move into higher gear. Peter Bonfield, president and general manager of ICL, understands this. "Declining profits are the major reason for our recent restructuring into three autonomous divisions: services (which include maintenance and information management, among other things), systems integration, and technologies," he acknowledges. Especially since ICL is still under attack by IBM in the large systems market. In September 1994, the British manufacturer was forced to reduce the price of its machines 25 percent in response to a Big Blue price cut on Open VME.

"ICL is feeling pressure from its installed base," comments George O'Connor, IDC analyst in London. Hence an in-depth reorganization that has resulted in abandonment of its nonstrategic activities and a simplification of its structure. Last January it sold its information security division, Guardian Computer Services, to a risk-capital company, ECI Ventures, that has ties to the Paribas bank.

In the maintenance domain the British builder, in partnership with U.S. telecommunications operator Bell Atlantic, totally assimilated their joint subsidiary Sorbus last February. The new entity, called "ICL-Sorbus" and headquartered in Paris, will have annual turnover of about 500 million pounds (half of it on the British market), with 5,000 employees in 15 different countries.

This move helps meet two objectives: generating economies of scale, and offering users—especially multinationals—a "one-stop" contact. The result: ICL has catapulted itself into fourth place on the European

multivendor maintenance market, after IBM, Siemens-Nixdorf, and Digital. Paul Whithwam, head of ICL-Sorbus, expects to boost turnover over the next 5 years to 1.6 billion pounds. Last August Microsoft selected ICL to handle maintenance, systems integration, and training in operating its products, in the framework of an accord covering all of Western Europe.

Reorganization is also the order of the day for ICL in systems integration. The builder has consolidated all its activities in this domain, plus its Open-framework division (Fujitsu-based development methodology), under the aegis of ICL Enterprises, an entity expressly devoted to big-ticket projects. And it's had some success: As part of its thrust into East Europe, McDonald's, the world's number one fast-food enterprise, entrusted ICL last November with the tasks of project management, training, installation and maintenance of its systems, and provision of microcomputers and network servers.

In addition, the builder has captured major contracts with the British National Lottery and with Eurostar, the latter for management of its ticketing, reservations and embarkations system (a contract worth 30 million French francs [Fr]). "This is one example of the type of prime contractor role we are seeking: The British system operates under DOS [Microsoft Disk Operating System] with an Ethernet LAN [local area network] and Novell Netware; SNCF [French National Railroad Company], on the other hand, favors OS/2 with a LAN Manager local network, while the Belgians are using Decnet with VMS databases," according to sources at ICL France.

Eventually, the services and systems integration divisions should logically be expected to overtake sales of PCs and servers. Especially since they are considered high-growth markets. According to Input, systems integration will grow 13 percent per year between now and 1999—while in Great Britain, a market where ICL has obvious advantages, growth will be as high as 23 percent. According to top management at ICL, turnover from systems integration has grown 25 percent per year since 1991 and should amount this year to 350 million pounds (about Fr2.8 billion). Likewise, in the maintenance domain, the most promising niche is precisely the multivendor systems segment favored by ICL. According to Input, such systems will account for about 35 percent of the European market in 1999, versus the 20-percent share they command today. To the detriment of services in proprietary [computing] environments.

[box, p 32]

Exploiting Fujitsu

Besides services, the second front of ICL's offensive is in the microcomputer domain. In September 1994 ICL formed an alliance with Virgin for marketing under the Virgin label PCs built at ICL plants in Great Britain. Supported by an advertising campaign costing 15 million pounds (about Fr120 million), ICL is going for big volume. Which means a change in distribution strategy. Up to now, servers and PCs—in future they will bear the Fujitsu/ICL label—were mainly sold by direct marketing. "Henceforth, we will market indirectly and to partners such as Computacenter in the United Kingdom and Vobis in Germany," says David Mills, head of ICL's mass-market products division. The builder claims to have sold 290,000 microcomputers last year, versus 230,000 in 1993 (300,000 was the target) and 217,000 in 1992.[end box]

Netherlands: Fokker Announces Restructuring

95WS0191A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 65

[Article by Bernard Bombeau: "Fokker's Difficult Plight"]

[FBIS Translated Text] Recapitalization and job cutbacks are inevitable. The release late last year of results of an audit of the Dutch company has created shock waves. According to the study, the airplane builder is on the verge of bankruptcy, with losses of 460 million florins (1.38 billion French francs [Fr]) for 1994. That loss is all the more disastrous because it is so close to the loss posted for 1993; what's worse, turnover for 1994 declined by about 20 percent. Its stock, meanwhile, has fallen off 14 percent.

Fokker apparently will have no choice but to turn once again to its principal shareholder, Germany's Daimler-Benz Aerospace, which holds 51 percent of the Dutch enterprise's capital. But this time Fokker will need several hundred million florins if it hopes to get over the hump, plus help from the Dutch government, which still holds 22 percent of the shares. In response to the audit report, the enterprise has announced a new restructuring plan to be presented in February. The plan envisions closing three production plants, which would eliminate about a thousand jobs, instead of the 500 previously slated for 1995. Delays in reducing the debt burden and in putting new structures in place, combined with the slump in demand, have inflamed competition among major European and Canadian airplane manufacturers in the regional aviation market. Forced to slash profit margins, Fokker has been hit especially hard by the recession. But with its twin-engine Fokker 100 and 70, it has some very competitive products to offer in a rapidly growing market niche. More than ever, the future of the firm seems to be tied to the Europeanist industrial restructuring now under way.

Activities in Philips' Central Research Laboratory Described

95WS0266A Stockholm NY TEKNIK in Swedish 16 Feb 95 p 14

[Article by Erik Mellgren: "1,800 Researchers in the Biggest Lab;" first two paragraphs are NY TEKNIK introduction]

[FBIS Translated Text] **Nat Lab in Eindhoven is Philips' most important research center. It is also one of the world's largest company-owned research laboratories.**

NY TEKNIK has visited Nat Lab and met researchers who work with extremely fast fiberoptic communication, light diodes of plastic and new technology for flat screens.

Eindhoven, a medium-sized Dutch city, near the border with Germany, is the central location for the Philips conglomerate. Here is where the company headquarters is located, several manufacturing units as well as Philips' oldest research center, Nat Lab, Natuurkundig Laboratorium.

All in all, Philips has five research laboratories with a total of 3,000 employees. The others are in Germany, Great Britain, France and the United States. But Nat Lab is definitely the biggest, and 1,800 persons work in the buildings on Professor Holstlaan. Its function as a laboratory is tangible; it has broad corridors with clearly marked supply pipes for gases and such.

"Recently there was a visitor who said that 'it looks exactly like a hospital,'" says Dr. Marianne Vincken, in charge of information at Nat Lab.

Nat Lab's research field is very broad. Some examples of research areas: various video screen technologies, materials science, magnetic and optical storage of image, sound and data, design and manufacturing processes for integrated circuits, interfaces between human and machine and transmission systems.

Glowing Plastic

The small glass plates glow yellow and green and red and orange. They are coated with light diodes of "plastic," semiconducting polymers.

"One advantage with the polymer diodes is that we can get any color we want," says Emil Staring and leans toward a fume cupboard, from which large, black rubber gloves are sticking out.

"You just mix the materials, just as when you mix paint."

In Sweden researchers at the Linkoping institute of technology, among others, work in the same field as Philips. Some of the advantages with the polymer light diodes is that the manufacturing technology is relatively simple, that they can be made large and that they are flexible. The light intensity per unit area is not so great that they are bright enough for lighting applications, but they are sufficient for displays. And completely new application purposes are also conceivable, of course.

"Yes, a telephone that lights up when it rings is one of the most popular suggestions when we talk with visitors," Emil Staring explains.

The light diodes are based on a transparent substrate, usually glass although plastic film is also possible. To the glass is applied a thin, transparent bottom electrode of indium titanium oxide. The semiconductor polymer is put on top as a fluid diluted with a solvent.

When the solvent has evaporated, a very fine polymer film forms. Its thickness can be very carefully controlled. On top of the film another electrode, for example of aluminum, is then applied through vacuum coating.

One problem is the life of the luminous plastic. At present it is about 1,000 hours of operation.

"But one must not exaggerate the difficulties," says Emil Staring.

"If we look at how long we actually use a car or a computer, we see that 1,000 hours of operation in reality corresponds with several years of normal use. It is fully sufficient for many applications."

In the continued research at Philips attempts are being made to increase the life and light yield, among other things. Today the polymer light-emitting diodes provide about 1,000 candela per 10 square centimeters. With better understanding of the fundamental phenomena, it is hoped to achieve up to 10,000 candela per 10 square centimeters. Then they could even be used for certain illumination.

Full Speed Ahead for Fiber

Roll after roll of fiberoptic cable lies piled on the laboratory counter at John Reid. Last fall his group set a world record for transmission rate for ordinary fiberoptic cable. It transmitted data at 20 gigabits per second over a distance of 200 kilometers, approximately eight times faster than today's usual transmission speed.

Most of today's fiberoptic telecommunications networks are built with so-called single-mode fiber. In it the transmission speed is limited by the fact that the light impulses become stretched.

This, in turn, is due to the fact that the speed of light through the glass varies with the frequency. Although the laser light from the transmitters in the network is very pure, it still has a certain spread in wavelength which is noticeable over large distances. For that reason the light is recreated electrically.

In the Philips experiment there was instead just an optical amplifier for every 50 kilometers. John Reid's group utilizes a physical phenomenon which is called solitons in order to reduce the spread.

"If we send in sufficiently high power, non-linear phenomena occur," John Reid says

"The refraction index of the fiber is affected, and the most for the high frequencies that otherwise go the fastest. It slows them down so that the pulse is kept together."

"It is sort of as if a group of runners were running on a mattress which curves down in the middle. The one who is at the front must always run uphill and the last one has a downhill incline the whole time."

In order to get solitons, various amounts of power are required at different wavelengths. The Philips system operates at 1,300 nanometers, which requires must less power than with the 1,500 nanometers used until now.

Previous laser amplifiers for 1,300 nanometers were both large, complicated and expensive. But Philips newly developed amplifiers, which was used in the test, is small and compact. It uses a quantum well laser and is less than 10 centimeters long, including cladding and connections.

But is all this capacity really needed? Isn't the capacity already provided by the fiberoptic cable networks enough?

"Well," says John Reid, "if you need pay-per-view video and graphics and data traffic and a lot of other stuff through the networks you cannot avoid that it involves a lot of people and data and the same old optical fibers."

"Our goal is to achieve 40 gigabytes per second. U. S. MCI has asked us if we can manage that. They want to use that speed in their existing fiberoptic network in New York."

Irresistible Screen

I feel overcome by impatience and a desire to possess as soon as I enter Hugo Cornellissen's room. There are lots of monitors that claim to be as white as paper. But here they actually look like paper. A white, opaque surface with dark text, letters that don't disappear or fade when I move my head.

Finally a really good, flat screen that does not require background lighting. The dream screen for a briefcase computer—and for the desk, too, for that matter. The screens in general reflect as much of the incident light as ordinary white paper, about 70 percent. At the same time the contrast is high. That is where no background light is needed, which otherwise is the largest consumer of power in modern briefcase computers.

But I must wait. As yet the screens exist only as prototypes and experiments on the laboratory counter here at Nat Lab.

"The screens use liquid crystals in a different way than in ordinary crystal screens," Hugo Cornelissen explains.

"Ordinary screens always contain polarization filters. Then at least half of the incident light disappears from the beginning."

In the new screens the crystals exist as very small droplets in a polymer material squeezed between two glass plates. The diameter is about 10 microns.

The principle is called PDLC, polymer-dispersed liquid crystals. In addition to Philips, several other companies and academic institutions do research in this field.

But in order to get really high reflectance, the correct paper appearance, a few tricks are needed. Intrinsically, the polymer does not get any whiter than a matte-polished glass plate. But when I look carefully I see that the letters are shiny and glitter a little. The back of the screens has mirrored layers in various colors in order to get the best reflection. Hugo Cornelissen says:

"It is one of the details we want to go further with."

"We will probably have to work another two years with fundamental problems. Then it is a matter of transferring our knowledge to production."

Italy: Olivetti Managing Director on Company Strategies

MI2803102395 Turin MEDIA DUEMILA in Italian Feb 95 pp 21-25

[Interview with Corrado Passera, managing director of Olivetti, by unidentified reporter; date and place not given: "The Moment of Truth"]

[FBIS Translated Excerpt] [passage omitted]

[MEDIA DUEMILA] What are your strategies and objectives and how are you tackling them?

[Passera] Before answering I would like to go back to the goals I set myself when asked to take over as managing director. My program was a three-year one with specific targets to be achieved over three years.

For 1993 the objective was to start growing again after two years of falling revenues and this objective was achieved and reconfirmed in 1994.

For 1994 another objective was to balance the operating costs and this was achieved as early as the first half of the year.

For the third year, which has just begun, the objective is to bring the group back to generating profits and this is what we are focusing on.

However these objectives, though fundamental ones that cannot be delayed, do not fully highlight was has happened and is happening within the company. It is an extraordinary process of organizational transformation and strategic refocusing by the group in light of the new cycle of the information technology industry.

The process of organizational transformation has greatly modified our way of managing key functions such as the production and distribution of products, time to market, systems development and integration, professional and assistance services (Oliservice). This has allowed us to create an extremely flat and basic structure with an exceptional increase in productivity and reduction in operating costs (minus 14 percent in 1994 despite the growing revenues).

However the downsizing of the company (which currently operates with 40 percent less staff) was not the sole objective. The goal is to create a flexible structure that can compete in the new scenario where "virtual" companies or companies with a staff of just a few hundred people and minimal operating costs find themselves having to operate in a highly competitive manner.

In conjunction with the major effort toward organizational transformation, there has also been a major effort to strategically refocus activities on the key areas in this new scenario. Especially toward the most innovative areas of multimedia and the converging of computers and telecommunications, toward new services and added-value networks.

The Telemedia division was created to accelerate the group's entry into the more innovative areas of multimedia and computer networks, as well as its obtaining a license as the second Italian supplier of GSM (global system for mobile communications) for digital mobile telephony through Omnitel. These are the two most obvious reference points in a strategy that was fully evident during 1994 and that will become increasingly stronger this year.

However the strategic refocusing process has affected all the activities of the group from products to services.

[MEDIA DUEMILA] What stage has the difficult process of transforming a traditional computer company model to a new supplier model of new integrated circuits reached?

[Passera] Olivetti has no intention of giving up its expertise and presence as a hardware producer in this evolution toward increasingly more "immaterial" supply.

We are the leading European producer of PC's and printers and we plan to strengthen this position, though we face extremely strong worldwide competition and the ongoing price war has brought gross margins to unthinkable levels.

Olivetti has developed technological expertise in the area of ink jet printers and this is being successfully applied to numerous products, from printers to calculators and faxes. We produce hundreds of thousands of products also that are also sold to overseas emerging markets and to other foreign manufacturers.

I am convinced that while the strong Olivetti product culture makes the cultural leap toward the supply of services and primarily immaterial complex goods more complicated, it can be a positive factor in the process of integrating complex hardware-software solutions and services.

Olivetti is increasing its leadership in Europe as a servicing supplier. For example it would have been impossible to create the desktop service without a solid base of know-how as a hardware producer. The success of Oliservice is the best guarantee of success in the evolution of Olivetti as a supplier of integrated and innovative services.

[MEDIA DUEMILA] What does the accelerated convergence between computers and telecommunications represent for Olivetti?

[Passera] Rather than being the convergence of computers and telecommunications, it is the convergence of the 4C's in which alongside components, computers, and communications, is the word "contents" meaning the suppliers of information, from information providers to the media in general.

Who among the various players with different backgrounds will have the upper hand? My answer is: Completely new players that are emerging now or others that will know how to change better and faster.

Olivetti plans to be among these, by using its knowledge of the capabilities of decentralized computers (we are personal computers not great processors) and the needs of the final user (for example, Olivetti is the European leader in the market of bank branches, that is, the branches of organizations where the real needs of the user are evident.)

And by operating both in network services (from Onmitel to satellite networks) as well as in the supply of multimedia "contents" (Opera Multimedia).

[MEDIA DUEMILA] What role do you intend having in the development of information highways?

[Passera] The role that Olivetti played through its president Engineer De Benedetti in launching the topic of information highways and the information society in Europe is well-known.

We are now working along the lines of the Bangemann report on the information society in Europe. Both by participating in the construction of new highways when the telecommunications liberalization process will permit this with the Omnitel network that is actually the first "information highway" to become available in Italy and with satellite networks (in collaboration with Hughes), and by setting up new applications for European telematics.

At the end of 1994 Olivetti launched its first operational initiative within the framework of the 10 priority areas listed in the Bangemann report: The Remedes project in the field of health telematics providing for the creation of family doctor networks in Italy and the United kingdom through the Sema group.

Other initiatives are being drawn up. We will use these projects to promote the development of new applications and new demand, both in society and in single families, thereby making a concrete contribution to the creation of the information society. [passage omitted]

German Experts on Laser Cooperation with Russia

95WS0260A Coburg OPTOELEKTRONIK MAGAZIN Feb 95 p 3

[Articles by Dr. Holger Junge, VDI Technology Center, Duesseldorf, and Dr. Dirk Basting, business managing partner, Lambda Physics Ltd, Goettingen: "Ex Oriente Lux? [Light from the East?]: Laser Cooperation with Russia and Other East European Countries"]

[FBIS Translated Text] *Is it import of useful know-how or loss of jobs in Germany that brings about a cooperation with east European institutes and commercial firms? We asked Dr. Holger Junge of the VDI (Verein Deutscher Ingenieure) [Association of German Engineers] and Dr. Dirk Basting, business managing partner of the Lambda Physik GmbH [Lambda Physics Ltd] in Goettingen], for their opinions.*

The Idea and Its First Fruits: Successful Cooperation

Article by Holger Junge, Duesseldorf

In August 1992, Germany's and Russia's Ministries of Research signed a special-interest agreement concerning laser research and technology. This agreement formalizes the great interest in cooperation and facilitates cooperation in the setup of research establishments on both sides. Two years after this political declaration of intent one can state that this cooperation has been met with great enthusiasm by both parties.

Russian as well as German scientists and research establishments hope that joint research will accelerate the development of useful items. An example of successful cooperation is development of special tools for laser-beam treatment which are much lighter and more easy to handle than conventional ones, these tools having been developed jointly by the Bremen Institute of Applied Radiation Beam Technology and the St. Petersburg University. Another example is research relating to crystalline lasers with new properties done jointly by Carl-Zeiss-Oberkochen and FIRN Krasnodar, such lasers being ready for incorporation in next-generation devices.

Alongside joint projects targeted for specific developments there is also joint work being done relating to basic applications, such as use of lasers for measurements and in medicine. In the CIS countries one frequently meets highly qualified and highly motivated scientists who see cooperation with German research establishments as a chance to implement their ideas. At the same time the cooperation facilitates recruitment of prominent research teams from the former Soviet Union in these times so particularly difficult for research and expresses in concrete terms Germany's efforts supporting the democratization process in the CIS countries.

The path leading to the over 20 cooperative efforts of German and CIS establishments was, naturally, not as simple and smooth as it now appears. In addition to problems in understanding and communication there was also a need to exchange knowledge for establishing a common ground and to build a mutual trust.

It must not be forgotten that in the Soviet Union prior to its breakup laser research was mostly military-oriented and, therefore, strictly classified. Verification of contemplated joint projects was and still is difficult, because initially huge research structures are being increasingly broken up into smaller ones. For the purpose of solving these numerous communication problems, the VDI Technology Center-Duesseldorf has set up an Information and Continued Education Office in Moscow which it operates jointly with the "Laser Association"—the most important independent laser group in the CIS. The team which works there under the leadership of Professor Kovsh dispenses information about the capabilities of CIS facilities and forwards inquiries from the CIS to Germany. Since its opening the office has become a dial-a-number exchange for cooperation initiatives spreading into areas beyond laser technology.

The second principal task of this office is continued education of CIS laser specialists in business administration and science management, this being probably the most important area of concern which will influence future relations. In this area, too, German outposts offer standby assistance. Both the Institute of Development Planning and Structural Research at the Hannover University (which also counsels German firms concerning the not always clearly understood structures of CIS enterprises) and the Teaching-and-Consulting Ltd from Dresden have actively participated in a three-weeks' long course and a three-months' long course on how to plan projects which the Federal Ministry of Research and Technology will sponsor.

It was thus possible to educate many more than 70 specialists from new or uprooted firms so as to qualify them for cooperative effort under conditions of a market economy. The tremendous response of the participants persuaded the VDI Technology Center to draw on the resources of the European Union in Brussels for conducting further courses.

Achievements of this cooperation will be displayed during the LASER '95 Exhibition, in the Commonwealth of Independent States pavilion financed by the Federal Ministry of Science just as it had been in 1993.

One of the workshops conducted in early summer 1994 in Dresden brought together from Germany and CIS countries all participants in projects sponsored by the Federal Ministry of Research and Technology. This workshop made it quite evident that, after initial hurdles have been overcome, the cooperation is now regarded to be meaningful for both sides. Only this kind of cooperation, one meaningful for both sides, will in the long run remain effective and thus desirable.

From the Viewpoint of the Laser Manufacturer: Cooperation is Welcome

Article by Dirk Basting, Goettingen

For some time there have been contacts established between German and Russian research institutes, ideas having also been exchanged at science congresses. Some of the Russian achievements are, because of their strong military engineering orientation, quite far advanced. Closer expert examination reveals that despite record achievements, however, progress there has remained behind what it would have been in a German environment, this being partly due to shortage of materials or because of lack of convertibility to an industrial base. Here is, I believe, where the possibility of cooperation comes into play. It may be less important whether manufacturing is or will be done in Russia than it is to utilize the Russian research and development know-how and support the work done by respective institutes and firms toward creation of joint products. Because of still existing infrastructural problems in Russia, I do not regard manufacturing in that country to be a very interesting idea. As far as potential benefits are concerned, the difficulties will by far offset the lower labor wages.

Wherein then lie Russian interests, when the deal involves merely acquisition and utilization of Russian know-how by Germany? Inasmuch as know-how can obviously not be procured at no cost, reasonable licensing and know-how transfer agreements are called for which will also benefit the Russian side.

An exchange of scientists is another useful feature of such cooperation, not only benefiting the German side by enabling it to acquire the know-how in a direct way but also benefiting the Russian side by making it understand the German principles of enterprise and the German manufacturing infrastructure. It can be expected that this may, in the long run, lead to creation of Russia's own industry. Even though I have initially ruled out the practicality of manufacturing in Russia, there may nevertheless be individual cases where this should be considered, as for instance in construction of a complex multistage laser apparatus or a laser apparatus which must satisfy extra severe requirements, where the main difficulties have to do with experimental work and with personnel so that it may be appropriate to install relevant material and equipment in Russia, complete the outfitting there, inspect everything according to specifications, build on individual components, and then offer the entire apparatus for sale. In the case of particularly expensive devices meant to be produced in small quantities down to only a few units the infrastructural disadvantages are, moreover, such a significant factor. Besides, communication has lately much improved and is now free of problems creating an unsurmountable obstacle.

Also in the area of peripherals (accessories) there are developments taking place in Russia which so far have been successful enough to make small-scale series production already a reality. Deliveries from Russia are quite conceivable, especially when long lead times are acceptable.

The cooperation between German and Russian institutions so actively supported by the Federal Ministry of Research and Technology can, in my opinion, be only welcomed. It provides an important instrument for enhancing the competitiveness of the German laser industry as well and, therefore, makes sense in terms of Germany's enlightened self-interest.

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